THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 38. Thursday, May 3, 1928. No. 611.

PUBLISHED WEEKLY

Subscription Terms: 15s. per annum.
Foreign and Colonial, 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.

Telephone: Gerrard 3961 (4 lines).
Telegraphic Address: "Zacatecas, Rand, London."

Contents.

	PAGE
The Iron and Steel Institute's May Meeting	311
Limiting the Liability of the Foundry	311
Sheffield's Second Loss	312
Random Shots	312
Correspondence	313
I.B.F. Elects New Members	314
Nitrated Chrome Steel Cylinders	314
Some Experiences in Practical Moulding	314
The Influence of Nickel on Iron-Carbon-Silicon Alloys Containing Phosphorus	316
The New President of the F.T.E.S.A.	318
Buchanan Medals Inaugurated	318
Blast Furnace Practice in Natal	319
A Record Repair Job	321
Illness of Mr. Stubbs	321
Institute of British Foundrymen	312, 313, 322
Carron Foundry Tragedy	322
Newcastle Founders Visit South Shields	323
Customs of the Trade	323
Trade Talk	324
Personal	324
Contracts Open	324
Company Reports	324
New Companies	324
Obituary	324
Britain's Largest Jar-Ram Squeeze Moulding Machine	326
Iron and Steel Markets	326

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT: 1927-28:
John T. Goodwin, M.B.E., M.I.Mech.E.,
The Red House, Old Whittington, Chesterfield.

LIST OF SECRETARIES—

General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office, 49, Wellington Street, London, W.C.2.

Birmingham: F. K. Neath, 24, St. Paul's Square, Birmingham.

Sheffield: T. R. Walker, 26, Castlewood Road, Fulwood, Sheffield.

Scottish: J. Bell, 60, St. Enoch Square, Glasgow.

Lancashire: H. Stead, 1st/36, Cheetham Hill Road, Stalybridge, Cheshire.

London: H. G. Sommerfield, Charterhouse Chambers, Charterhouse Square, London, E.C.1.

Newcastle-on-Tyne: F. Sanderson, 10, Westgate Road, Newcastle-on-Tyne.

East Midlands: H. Bunting, 82, Otter Street, Derby.

West Riding of Yorkshire Branch: S. W. Wise, 110, Pullan Avenue, Eccleshill, Bradford.

Wales and Monmouth Branch: J. J. McClelland, M.I.Mech.E., Druslyn, Bishops Road, Whitechurch, Glam.

Middlesbrough: N. D. Ridsdale, 3, Wilson Street, Middlesbrough.

Foundry Trades Equipment & Supplies Association.

President: H. Winterton,
Kelvinvale Mills, Maryhill, Glasgow.
Secretary: K. S. Bridges, Avenue Chambers,
Southampton Row, London, W.C.1.

Welsh Engineers' and Founders' Association.

Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION.
The Registered Office and Laboratories of the B.C.I.R.A. are at:—
24, ST. PAUL'S SQUARE, BIRMINGHAM.
Telephone: Central 1885. Telegrams: CIRA.
The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk (*Telephone 332.*)

Forthcoming Events.

MAY 8.

Institute of Metals:—Annual May Lecture by Professor Cecil H. Desch, D.Sc., Ph.D., F.R.S., on "The Chemical Properties of Crystals."

Institution of Mining and Metallurgy:—Annual dinner at the Hotel Cecil, London.

Institution of Petroleum Technologists:—Ordinary meeting in London.

MAY 9.

Institute of Fuel:—Ordinary meeting in London. "The Engineer in Industry," Paper by A. J. T. Taylor.

MAY 11-15.

Society of Chemical Industry:—Conference in London. "The Fuel Industries and the Work of the Chemical Engineer," Paper by Sir Arthur Duckham.

Institute of British Foundrymen.

MAY 5.

Lancashire Branch:—Ordinary meeting at the College of Technology, Manchester. "Modern Blast Furnace Practice," Paper by R. Sharp.

The Iron and Steel Institute's May Meeting.

The meeting of the Iron and Steel Institute which opens to-day is perhaps of more interest to the blast furnaceman and the steelman than to the ironfounder. This state of affairs is usual and no doubt inevitable, but recent experience has been inclined to spoil us. At the Glasgow meeting last September there was Dr. Hanson's paper on his theory of the cast irons—a paper whose reverberations are still being felt in the technical press abroad; while at last year's May meeting there was published the group of N.P.L. papers on the alloys of iron research.

It is, however, clear from the programme that Dr. Hanson is maintaining the tradition founded by Professor Turner at Birmingham, and continues to pay special attention to cast iron, and this in itself is extremely satisfactory. Had he done otherwise it would not have been for us to complain, for conscious effort can do little in such cases. Our traditions are not achieved like those of the college captain, who announced one morning from the notice-board that "From to-morrow morning the following tradition will begin. . . ." They must represent a reality and spring spontaneously from it. For the present, the work on nickel in cast iron is continued by an examination of the influence of phosphorus, which is especially interesting because the influence of phosphorus upon carbon is cast iron—that is, upon chilling properties and hardness—is still open to some speculation.

Another interesting paper is that upon blast-furnace practice by Messrs. Evans & Bailey—interesting not merely for its intrinsic value, but further because it shows how similar are the lines on which the study of blast-furnace problems and the study of foundry problems is proceeding. The cupola and the blast furnace, after all, have certain resemblances, as have grey and pig-iron. The more academic or laboratory method is represented by last year's May paper on gas and ore reaction in the blast furnace (Bone, Reeve and Saunders), and this week's paper on coke reactivity (Jones, King and Sinnatt). The paper previously referred to, however, represents the more practical approach, based upon current practice and upon the recording and correlation of results therein. Both methods are necessary, and ultimately they reach the same destination.

Finally, while the question of steel ingots does not directly affect either iron or steel founders, the reports of the special committee on the heterogeneity of steel ingots contain information of great interest to those engaged in the casting of steel. This applies especially to the questions of inclusions and of segregation, which were dealt with two years ago. In the same way, the very comprehensive and useful report discussed this week deals largely with ingot-moulds and the properties of the cast iron required in their making. It should be neglected by no founder who makes ingot-moulds for steel ingots. Indeed, no founder or foundry metallurgist who is interested in the functions of manganese and its relationship to sulphur, in the modes of solidification of iron, in segregation and inclusions, or any other live metallurgical problem, can afford to neglect these reports.

It will be seen, therefore, that although the interest is possibly less direct than on other recent occasions, the meeting in question is well worth the attention of founders, and they will no doubt follow its progress with close attention.

Limiting the Liability of the Foundry.

We understand from the legal profession that the American code of laws is largely based on the British. If this is accepted, then the standard trade customs evolved by the Steel Founders' Society of America, and printed elsewhere in this issue, should be of the greatest value to the British foundry industry. The twenty clauses cited are truly comprehensive, and appear in every way to be suitable for adoption by the British industry, except that, owing to the smallness of this country, the time limits cited in clauses 2 and 17 could be usefully reduced. Again, it may be considered desirable to change the word "should," which appears so frequently, to "must." We would call attention to clause 12, which reads, "All transportation charges on pattern equipment to and from the foundry shall be paid by the customer." This is really the custom of the trade in Great Britain, and any deviation from it can be considered as a special condition.

The introduction of clause 6, which has reference to the supply of poor patterns and their liability to being surcharged, is, to our mind, legally useless, but it certainly is a useful reminder to the customer of his moral obligation to provide either a workable tool or the money for its modification to render it so. The most important clauses are the last three—18, 19, 20—which define in clear terms the liability of the founder to the customer in respect to defective castings.

Two numbers, 18 and 20, are negative clauses (*not* responsible for machine work on defective castings, and *not* liable for consequential damages) and number 19 positive (the right to replace defective castings). Legally, we should imagine this is sound because definite consideration and implied obligation is indicated, which nullifies any objection which a court of law may have to "onesidedness"—a *factor* which *may* be regarded as a *right* in the non-fulfilment of any contract. We are aware that the law of the land takes care of some of the clauses, but their attachment to quotations or a saving sentence, "subject to the current conditions of sale as published by the —— association," would at least place every foundry on the same legal liability as the rest of the industry. Finally, we congratulate the Steel Founders' Society of America on the production of a creditable piece of constructive protection for their industry, and commend the work for the close deliberation of the various foundry associations of Great Britain.

Institute of British Foundrymen.

Lancashire Branch.

The annual general meeting of the Lancashire Branch of the Institute of British Foundrymen was held on April 14 at the Manchester College of Technology, Mr. J. S. G. Primrose presiding.

The balance sheet showed that the Branch began the year 1927 with a balance of £24 16s. 6d., which had been reduced to £18 12s. 2d. on December 31. The expenditure included grants of £7 to the Burnley Section and £5 to the Junior Section, and also a loan to the Junior Section of £6 8s. 9d. The Chairman explained that originally this was regarded as a debt to be paid by the Junior Section, but its subscription was not more than enough to cover the ordinary working expenses. Therefore this sum would be treated as a grant. The Junior Section was a recruiting ground, its work was in the nature of propaganda with the object of bringing the juniors to the stage when they could be valuable members of the Branch.

Mr. Masters observed that so far not much had been done in the way of recruiting. Steps should be taken to bring more of the juniors into the senior section.

The balance sheet was passed unanimously.

In his report upon the year, Mr. H. Stead (Secretary) said from the numerical point of view there had been a slight advance. Recently a sub-committee had gone through the list of members in arrears and some names had been erased from the register. Altogether, by exclusion, resignation or transfer to other branches, 28 members had been lost (including one subscribing firm). On the other hand, there had been admitted 14 members, 22 associate members, and 2 associates, making a net gain in membership of 10 in the year. The numbers now were 114 members, 193 associate members, 11 associates, and 11 subscribing firms, a total of 329. The arranging of the syllabus required much earnest thought, patience, and tact; the Council would be grateful for suggestions from the members or assistance in the way of reading Papers. They would like more of the Branch members to come forward in that way, so that there would be less necessity to resort to people outside. Works visits had been a very important and very popular part of the Branch's activities. The joint meeting with the West Riding Branch in November took the form of a visit to the works of Messrs. David Brown and Sons, of Huddersfield, followed by tea and a most interesting lecture by Mr. Rowe. It was attended by more than 70 members of the Lancashire Branch, and a similar number from the West Riding. The Burnley Section kept in touch with members of the Institute who found it difficult to attend the meetings at Manchester. The Junior Section continued its preparatory work among the younger members of the craft. The annual dinner, on February 4, was a very successful function, enjoyed by everybody, and it ended with a small balance on the right side.

A vote of thanks to Mr. Stead for his work was passed unanimously.

Progress with Test Bar for C.I.

The Chairman said he had received a letter from Mr. W. Jolley which gave an account of the work done by the Lancashire Branch Test Bar Sub-Committee, of which he was elected the Chairman in December, 1921. The other members were W. H. Meadowcroft, A. L. Key, F. Critchley, S. G. Smith, H. Grundy, and A. Phillips. After several meetings recommendations were forwarded in June, 1922, to Mr. J. Shaw, the convener of the I.B.F. Test Bar Committee. The other members of that Committee were the Chairmen of the various Branch sub-committees, who also forwarded recommendations. Afterwards the recommendations of the Institute and of the British Cast Iron Research Association were jointly considered for the purpose of forwarding a recommendation to the British Engineering Standards Association. That Association formed a Committee, of which he (Mr. Jolley) was a member, to frame a British standard specification for general grey-iron castings. After a number of years' work, approximately 60 meetings, and a large number of tests, this specification was now published for adoption and general use. Briefly there were two grades of castings, A. and C., with three sizes of test bars.

0.875 in. diameter tested at 12 in. centres.
1.20 in. ,, ,, 18 in. ,,
2.20 in. ,, ,, 18 in. ,,

Transverse Test.

Grade of bar.	Size of Bar.	Grade A.		Grade C.
"S"	0.875	1,185 lbs.	12 in. centres.	960 lbs.
"M"	1.20	1,950 ,,	18 in. ,,	1,600 ,,
"L"	2.20	10,000 ,,	18 in. ,,	8,950 ,,

Tensile Test.

"S"	12 tons	10 tons
"M"	11 ,,	9 ,,
"L"	10 ,,	9 ,,

The Lancashire Branch suggested the grade "A" figures for the transverse and tensile tests, and two of the grade "C" tensile-test figures. Their original suggestion was for grades "A" and "B" with similar load ratios, but their suggestion as to grade "B" was turned down and grade "C" was instituted, leaving grade "B" for future settlement.

Mr. Jolley enclosed letters which, in his opinion, showed the tenacious way in which the Lancashire Branch representatives stuck to their original suggestion. He thought the Branch members would be pleased to know the result of its Committee's work and he thanked them for the assistance and splendid co-operation which had enabled the work to be brought to a successful end.

Commenting on this letter, the Chairman said Mr. Jolley had acquitted himself very well in bringing this matter to a successful issue by hard and painstaking work.

Mr. S. G. Smith said some acknowledgment of Mr. Jolley's services should be recorded in the minutes.

Mr. E. Longden moved a resolution that Mr. Smith's suggestion be carried out. The motion was seconded by Mr. Smith and passed unanimously.

A vote of thanks to Mr. Primrose for his work as President was unanimously passed. In acknowledging it the Chairman said one noticeable feature of the Branch was the number of ex-Presidents who continued to take an active part in its work. He was the latest addition to their number.

THE NEW OFFICERS.

According to the normal procedure Mr. A. L. Key, as Senior Vice-President, would have been the successor of Mr. Primrose in the Presidency. The Chairman stated that Mr. Key, through circumstances beyond his control, felt himself obliged to withdraw from the offices he held. The gap was filled by Mr. E. Longden, who was recommended to the members by the Council. There was no opposition. The election of officers resulted as under:—President, E. Longden; Senior Vice-President, H. Jowett; Junior Vice-President, R. W. Stubbs; Council, E. E. G. Grimwood, J. Nicholls, A. Phillips, and W. Gilpin; Delegates to General Council, J. S. G. Primrose, J. Masters; Auditors, W. H. Grandison, W. Holland; Hon. Secretary and Treasurer, H. Stead; Assistant Hon. Secretary, C. F. Brereton.

Mr. J. Hogg read a short Paper entitled, "A Foundry Problem," the particular problem dealt with being how to lessen the cost of moulding boxes by using snap flasks. It was followed by a discussion.

Mr. W. Holland read a short Paper on "Refractories for the Cupola," which was also discussed.

Sheffield's Second Loss.

Only last week we recorded the loss that Sheffield industrial circles had sustained by the death of Commander Jackson. Now we have news of the passing of one of Sheffield's oldest foundrymen—Mr. John Fowler, chairman of the Don Foundry, Attercliffe. This foundry was established more than a century ago, and cast the first ingot mould for Sir Henry Bessemer when this process was first introduced about 1857. Mr. Fowler was 89 years old.

Random Shots.

It has already been said in these pages that the British delegation to the recent Spanish Fair and Congress was none too large; but it is, after all, needful to remember that it is barely six months since a considerable number of English founders visited Paris for a similar purpose, while our own I.B.F. Convention takes place in June. In addition, there are the spring, summer and autumn meetings of various organisations in whose work we are interested to a greater or less extent, and whose activities impinge more or less closely upon our own, and even if each only means a brief holiday from more serious work, still, even such brief holidays mount up amazingly. . . . A man may appreciate fully the advantages of these international gatherings, and he may be most anxious to attend them—and yet find it impossible to do so beyond a certain point.

* * *

At the same time, there is no doubt that on the whole the British business man does not make all the use he might of the opportunities afforded by international fairs, exhibitions, and conferences. There are certainly a great many of them—some people would say too many of them—and indeed it was reported last November that the International Chamber of Commerce had decided to inquire into the superfluity of these events. But even the most important of them receive but lukewarm support from this country. It was stated, for instance, after the last Leipzig Fair that British engineers had wasted most valuable opportunities and the scarcity of British exhibits was commented upon at the French Foundry Exhibition last September. Again and again we hear the same thing—too few British exhibits, too few British visitors. . . .

* * *

Why is it? Are we really so much less alive to the value of international contracts than other people? Do we alone among the nations fail to understand the connection between trade and markets? Or is it merely that tradition dies hard, and having once been branded an insular people we still believe ourselves to be such—even in these days of wireless and air transport, when the only really insular people in the world must surely be the residents on that southern island where the postal delivery happens once every two years. . . .

* * *

I am afraid I have dwelt almost too lovingly of late upon American topics—but these things happen to all of us from time to time. And talking about the Pullman porter, reminded me of an entertaining story—one of the best negro stories I know, as a matter of fact. Two travellers were in a Pullman ordering breakfast. "Say, Joe," says the one, "I'll have grape-fruit, and cereal, and coffee, and bacon and eggs." And his friend added, "Same for me, Joe, only you c'n eliminate the eggs." There was a long delay. Exasperated, the second traveller called the errant Joe, and demanded food. Joe looked worried. "Ve'y so'y, sah," he explained apologetically, "but we done gone bust dat 'liminator!"

* * *

And there is this one, illustrating the popular theory that the negro has a hard head and soft feet. A coloured girl called Mandy had just got married, after working for a number of years in a white family. Her former mistress met her one day limping badly, and apparently suffering from severe foot trouble. "Well, Mandy," said the lady, "what in the world have you been doing to your feet?" "It's like dis, Mis' Jones," Mandy replied. "D'you know dat fool coloured man o' mine he done hit me right on de head wid a great big club when I was a-standing on a hard stone side-walk!"

* * *

The Poets on the Problem of Founding.

"Ay me, what perils do environ
The man that meddles with cold iron."
(Butler.)

Marksman.

Institute of British Foundrymen.

Annual Convention at Leicester, June 12, 13, 14 and 15, 1928.

The 25th annual convention is to be held in Leicester from June 12 to 15, 1928. Every possible effort has been made to arrange a successful convention, and it is hoped that a large number of members and ladies will attend. The railway companies have agreed to issue tickets at the ordinary single fare and one-third for the double journey, fractions of 3d. reckoned as 3d. upon surrender, at the time of booking, of vouchers obtainable from the General Secretary. The tickets will be available from June 11 to 16, 1928. Numbers are limited at all the works which are open to inspection, and early application is necessary. Tickets are not transferable.

PROGRAMME.

Tuesday, June 12.

6.0 p.m.—General Council meeting at the Grand Hotel, Leicester.

8.0 p.m.—Reception at the De Montfort Hall, by kind invitation of the Mayor and Mayoress of Leicester (Alderman and Mrs. J. Thomas). Refreshments. Dancing from 9.0 p.m. Evening dress optional.

Wednesday, June 13.

9.15 a.m.—Conference opens at the Association Hall, Y.M.C.A., London Road, Leicester. Official welcome by the Right Worshipful the Mayor of Leicester (Alderman J. Thomas).

9.45 a.m.—Annual general meeting of the Institute.

10.30 a.m.—President's address (President-elect: Mr. S. H. Russell). Presentation and discussion of papers.

12.15 p.m.—Conference adjourns. Visit to one of the following works:—

(*a*) Stanton Ironworks Company, Limited (Centrifugal Castings Plant):

12.30 p.m.—Special train leaves L.M.S. Station, Leicester, for Stanton Gate. Return fare 3s. 6d. Members taking part in this visit are kindly invited to lunch by the directors of the Stanton Ironworks Company, Limited. Return train leaves Stanton Gate at 5.42 p.m., arriving Leicester at 6.20 p.m.

(*b*) The British Thomson Houston Company, Limited, Rugby.

1.45 p.m.—Motor coaches leave the Association Hall, Leicester. Return fare 2s. 6d.

(*c*) Wadkin & Company, Limited, Green Lane Road (Woodworking Machinery Manufacturers).

2.30 p.m.—Motor coaches leave the Association Hall, Leicester.

NOTE.—Members other than those visiting Stanton Ironworks make their own arrangements for lunch.

For arrangements for ladies on Wednesday morning and afternoon see ladies' programme.

7.15 p.m.—Annual Banquet at the Oriental Hall, Market Place, Leicester (evening dress optional). Tickets 10s. 6d. each. Member and lady 18s. Dancing at the conclusion of the banquet.

Thursday, June 14.

9.15 a.m.—Conference continued at Association Hall. Presentation and discussion of papers.

12.30 p.m.—Conference adjourns.

12.50 p.m.—Members, delegates and ladies leave L.M.S. Station, Leicester, by special train for Derby. Lunch will be served *en route*. (Train leaves Syston 12.58 p.m. and Loughborough 1.14 p.m.) On arrival at Derby members and delegates will visit one of the following works:—

(*a*) Ley's Malleable Castings Company, Limited.

(*b*) The London, Midland & Scottish Railway Company (Chief Mechanical Engineer's Department).

(*c*) Rolls-Royce, Limited.

Tea will be provided at each works by courtesy of the various firms.

6.5 p.m.—Members, delegates and ladies rejoin special train at Derby L.M.S. Station and proceed to Matlock Bath. Members, delegates and ladies are invited by the Convention Committee to dinner at the Grand Pavilion, Matlock Bath. If the weather is wet an entertainment will be held afterwards.

9.42 p.m.—Special train returns from Matlock Bath Station, arriving Derby 10.10 p.m., Loughborough 10.43 p.m., and Leicester 11.5 p.m. Return fare for the whole journey, including lunch, member 8s. 6d., member and lady 15s.

Friday, June 15.

9.30 a.m.—Motor coaches leave the Association Hall, Leicester, for Loughborough. On arrival at Loughborough members visit one of the following:—

(*a*) Herbert Morris, Limited.

(*b*) John Taylor & Company, Bell Founders.

(*c*) The Loughborough College.

12.30 p.m.—Recital on the Loughborough Carillon.

1.0 p.m.—Luncheon (members, delegates and ladies) by kind invitation of the directors of Messrs. Herbert Morris, Limited, at the Town Hall, Loughborough.

2.15 p.m.—Motor coach excursion to Charnwood Forest (members, delegates and ladies). Tea at Stoneywell Cottage, the residence of Mr. S. A. Gimson (Past-President).

4.30 p.m. and as required.—Motor coaches leave Stoneywell for Leicester and Loughborough. Return fare from Leicester to Loughborough, Charnwood Forest and back to Leicester, 7s. 6d. each.

LADIES' PROGRAMME.

Tuesday, June 12.

8.0 p.m.—Reception at De Montfort Hall (as members).

Wednesday, June 13.

10.15 a.m.—Visit to the works of Messrs. N. Corah & Sons, Limited, Hosiery Manufacturers, Leicester.

1.45 p.m.—Motor coach excursion to Belvoir, by invitation of the Reception Committee.

7.15 p.m.—Banquet (as members).

Thursday, June 14.

10.15 a.m.—Visit to historical buildings and other places of interest in the city.

12.55 p.m.—Train to Derby. Luncheon *en route* (as members). On arrival at Derby ladies are invited to visit the works of the Royal Crown Derby Porcelain Company, Limited. Tea will be provided by the Convention Committee at King's Café, St. Peter's Street.

6.5 p.m.—Ladies join members on excursion to Matlock Bath.

Friday, June 15.

9.30 a.m.—Motor coach to Loughborough (as members). On arrival at Loughborough ladies visit the works of Messrs. Zenobia, Limited, Perfume Manufacturers, or join the members in the visit to Loughborough College. The remainder of the day's programme as for members.

Alternative Programme.

9.30 a.m.—Visit to works of Liberty Shoes, Limited, Leicester (party restricted to 25), then proceed to Loughborough by motor coach, joining the members at the Carillon Recital and continuing remainder of day's programme as for members.

The starting place of all ladies' excursions from Leicester will be the Association Hall, Y.M.C.A., London Road.

PAPERS TO BE SUBMITTED.

Wednesday, June 13.

1.—*French Exchange Paper.* "A Study of the Phenomenon of Contraction in an Iron Casting," by M. Maurice Servais.

2.—"Malleable Castings," by W. T. Evans (member) and A. E. Peace (member), of Ley's Malleable Castings Company, Limited, Derby.

Thursday, June 14.

3.—*American Exchange Paper.* "Steel Castings for Severe Service," by John Howe Hall.

4.—"Aluminium Casting Alloys," by G. Mortimer, of William Mills & Company, Limited, Birmingham.

5.—*Belgian Exchange Paper.* "The Cohesibility of Rammed Moulds," by M. Ivan Laboureux, Vice-President, Belgian Foundrymen's Association.

6.—"Iron Foundry Costing," by W. R. Wintle, F.C.W.A., of Sheepbridge Coal & Iron Company, Limited.

REGISTRATION.—Members and ladies attending the Convention will receive, per post, prior to reaching Leicester, a registration card, bearing the member's registration number. This card should be exchanged as soon after arrival as possible at the Convention office for an envelope containing tickets requisite for the various functions and visits.

SOUVENIR BOOKLET AND BADGE.—A souvenir booklet, giving details of the programme and notes on the East Midland area, will be supplied to each member and lady attending the Convention. Each member and lady will also receive a badge.

CONFERENCE OFFICE AND INFORMATION BUREAU.—An office will be open in the Lounge, Y.M.C.A., London Road, for issue of tickets, booklets, etc., and for general information on Tuesday, June 12, 5 p.m. to 8 p.m.; on Wednesday, June 13, 9 a.m. to 12 noon, and on Thursday, June 14, 9 a.m. to 10 a.m.

CAR PARK is within one minute's walk of the Association Hall: Charge two hours 6d., all day 1s.

CORRESPONDENCE.—Members may have their correspondence forwarded to them during the Convention, addressed—c/o The Hon. Convention Secretary, Institute of British Foundrymen, Y.M.C.A., London Road, Leicester.

Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

A Point in Nomenclature.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The phrase, "chilled rolls are cast by ascension and centrifugally," occurring in Mr. Allison's article on chilled rolls, page 261, your issue dated April 12, naturally provoked my attention. In view of the fact that "casting centrifugally" is now practised in a more deliberate and definite fashion, the use of this phrase in the above sense may be considered to be wrongly applied. I suggest from Mr. Allison's description that the phrase, "chilled rolls are cast by bottom pouring, utilising a tangentially disposed gate or runner," would satisfactorily describe the method of casting.

This is really only a small point of terminology in the very excellent description of the manufacture of chilled rolls; but I believe it is worthy of comment.—Yours, etc.,

J. E. HURST.

Thorncliffe Centrifugal Casting Dept.,
Newton, Chambers & Company, Limited,
Sheffield.
April 28, 1928.

Foundry Education.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—After reading your Editorial of April 5, I do not think we differ essentially. The proposal at Michigan State College, as I understood it, was to teach the elements of applied metallurgy in the heat-treating field, just as a civil engineer is taught applied mechanics in the bridge and roof truss field.

The so-called case method of teaching, *i.e.*, the solution of actual problems, is too well established to-day to need any one to advocate it.—Yours, etc.,

S. M. UDALE.

Holley Carburetor Company, Vancouver Avenue,
and P.M.R.R., Detroit, Michigan.
April 16, 1928.

MESSRS. ROSE, DOWNS & THOMPSON, LIMITED, of Hull, have acquired the business of Sheepscar Foundry, of Leeds, which has closed down after sixty years of activity.

I.B.F. Elects New Members.

At a council meeting, held at the Midland Hotel, Manchester, on April 21, the following were admitted to the various grades of membership:—

As Subscribing Firm Member.

Reay Brass Foundry Company, Limited (Brass Founders, Eagle Works, Stockton-on-Tees).

As Members.

J. R. Bacon (manager, T. Broadbent & Sons, Central Ironworks, Huddersfield); W. R. Bates (manager of ironworks, Irthlingborough Ironworks, Wellingborough); C. J. Bloodworth (foundry owner, Sydney Junction); E. R. Briggs (works manager, English Electric Company, Limited, Rugby); T. E. Doodson (chief draughtsman, Vaughan Crane Company, Limited); T. H. Gameson (director, Britannia Foundry, Walsall); J. Hay (ironfounder, 86, Cotton Street, Bridgeton, Glasgow); J. H. Marr (director, Jas. Cook & Sons, Washington, Co. Durham); A. C. Millar (foundry manager, Fulwood Foundry Company, Limited, Mossend); T. F. Allen (mechanical engineer, 51, Norwich Union Chambers, Birmingham); F. H. Clark (ironfounder, H. Clark & Sons, Clapton, London, E.5); H. A. Clark (engineer and ironfounder, H. Clark & Sons, Clapton, London); G. C. Clayton (foundry manager, Northgate Ironworks Company, Limited, Bury St. Edmunds); B. A. Garman (works metallurgist, Steel Nut & Jos. Hampton, Limited, Wodin Works, Wednesbury); S. A. Hill (engineer, Providence Works, West Bromwich); P. Krishna Rao (superintendent of foundries, Mysore Iron Works, Bhadravati, India); J. Mason (foundry manager, Southern Foundries, Waddon, Croydon); L. P. Wilks (foundry manager, Sunbeam Motor Company, Limited, Wolverhampton); G. L. Mason (engineer, managing director, Cammell, Laird & Company, Limited, Sheffield); H. H. White (traveller, J. C. Waterhouse, Limited, crucible and plumbago manufacturers, Wakefield); W. A. Dawkins (managing director, Highfields, Bolton).

Transfer from Associate Member to Member.

L. A. Randle (chief chemist, W. H. Dorman & Company, Limited, Tixall Road Works, Stafford); J. Arnott (metallurgist, G. & J. Weir, Limited, Cathcart, Glasgow); J. Bell (foundry engineer, A. Smith & Company, 60, St. Enoch Square, Glasgow); T. G. Hilton (foundry foreman, T. Ashworth & Company, Rosegrove, Burnley); F. Hudson (works chemist, Glenfield & Kennedy, Kilmarnock, N.B.); J. Longden (D. & J. Tullis, Kilbowie Ironworks, Clydebank).

As Associate Members.

R. Armitage (moulder, Haslan Foundry Company, Derby); J. Black (foreman moulder, Northdownie Ironworks, Camelon, N.B.); J. M. Breckenridge (foreman moulder, Andrew, Barclay & Company, Limited, Kilmarnock, N.B.); J. A. Dawson (ironmoulder); E. O. Ellis (patternmaker, J. C. Balmforth & Company, 29a, Union Road, Nottingham); A. J. Humpage (steel moulder); G. Whitaker (ironmoulder, T. Ashworth & Company, Rose Grove, Burnley); W. L. Winterton (pattern-maker, J. C. Balmforth & Company, 29a, Union Road, Nottingham); J. Livingstone (foreman moulder, Younger & Gallon, Limited, Dunston-on-Tyne); W. J. Melrose (electric steel melter, Hopetown Steel Works, Bathgate); H. Milner (engineer, Mather & Platt, Park Works, Manchester); R. Mirrlees (moulder, Glenfield & Kennedy, Limited, Kilmarnock); P. Reece (iron moulder); S. E. Robinson (iron moulder, Entwistle & Kenyon, Accrington); D. Rushton (foreman, L.M.S., Derby); T. J. L. Slingsby (foundry apprentice, W. Slingsby & Company, Limited, Keighley); G. G. Stuart (chemist, Hopetown Steel Works, Bathgate); F. Varney (moulder, L.M.S. Railway, Derby); W. Waby (moulder, Humphreys & Wyre, Nottingham); W. Wayman (foundry foreman, Jefferies & Son, Hotwells); H. J. Cropley (foreman moulder, Crabtree & Company, Limited, Southtown Ironworks, Great Yarmouth); A. Herring (1st class craftsman, Royal Mint, London); J. Melling (pattern-maker); L. Norton (iron moulder); J. R. Nunns (foreman moulder, Vickers, Armstrong, Limited, Erith); B. Ramaseshaih (foreman, general foundry and pattern shop, Mysore Ironworks, Bhadravati); J. McKinty (engineer, Thomson & Lichtner Company, 80, Federal Street, Boston, Mass); S. Whitaker (chemist, Crofts, Engineers, Thornbury, Bradford); W. A. Booth (pattern-maker, Plowright Bros., Brampton Ironworks); J. R. Wilson (foundry inspector, Barr & Stroud, Limited, Anniesland), and S. F. Wise (pattern-maker, Hopworth & Grandage, Bradford).

As Associates.

S. Buchan (foreman over labourers, Willington Foundry Company, Limited); S. Cox (moulder, Willington Foundry Company, Limited); T. E. Crowe (pattern-maker, Sunderland Forge); W. Elsdon (moulder, Willington Foundry Company, Limited); A. A. Gibson (moulder, Willington Foundry Company, Limited); E. Gibson (moulder, Willington Foundry Company, Limited); E. Jagger (moulder, Willington Foundry Company, Limited); J. Kirkland (moulder); E. G. Lowes (marine engineer, Swan, Hunter and Wigham Richardson & Company, Limited); R. W. Robson (moulder); T. Savage (Pattern-maker, Sunderland Forge & Engineering Company, Limited); R. L. Challis (brass moulder, T. W. Dickson, Whitechapel); M. D. Doulton (engineering apprentice, Dewrance & Company, 105, Great Dover Street, London, S.W.4).

Nitrated Chrome Steel Cylinders.

An important Paper has recently been presented to the Académie des Sciences by Léon Guillet, a director of the Ecole Centrale, on the subject of the use of nitrated chrome steel in motor-car manufacture.

According to experiments that formed the subject of M. Guillet's Paper, the employment of nitrated steel for cylinders gives results never before attained; the steel has a hardness that produces unequalled durability and resistance. Exhaustive tests made by Birkigt, the designer of the Hispano-Suiza engine, showed virtually no wear in the pistons, whether of cast steel or aluminium alloy.

The use of polished nitrated steel is destined to have an important effect on the construction of bearings since the metal can come into contact with aluminium alloy such as duralumin without heating up, so that weight and complexity may be saved by the elimination of anti-friction devices or bushes.

Connecting rods mounted directly on a nitrated steel crankshaft gave 10 per cent. greater power at a speed of 3,000 r.p.m. The necessity for lubrication was diminished. In the recent contest between a Hispano and a Stutz car in America the Hispano, which was fitted with a nitrated steel crankshaft, used less than one gallon of oil during nineteen hours.

Guillet states that as a result of prolonged experiment in the laboratory of the Ecole Centrale he found that certain steels heated to 500 deg. C., while treated with ammonia, acquired an extraordinary degree of hardness. The ammonia combined with the aluminium in the steels selected to form a surface impervious to the file. According to the author nitrated steel liners in cylinders will diminish wear in motor engines to an unprecedented degree.

Austrian Magnesite Industry.—The Styrian magnesite industry has been doing fairly well recently, as all the foreign customers have well maintained their rates of purchases. About 90 per cent. of the output is exported, and only 10 per cent. is consumed in Austria. The Alpine Montan Company has its own quarry. The principal foreign purchasers are the United States, Germany, Great Britain, Czecho-Slovakia, Italy, Yugoslavia and Spain.

Some Experiences in Practical Moulding.

Last Saturday before the Wales and Monmouth Branch of the Institute of British Foundrymen Mr. A. Sutcliffe, of Bolton, gave a lecture bearing the above caption. It has been printed in full on page 185, *et seq.* of our issue of March 15.

Discussion on Mr. Sutcliffe's Paper being invited by the Chairman (Mr. Ben Hird) Mr. Williams referred to the horn gates, as shown, and contended that these should be run from the bottom and not from the top, as illustrated. When run from the bottom the pressure was greater and the mould would not draw at all.

Mr. Sutcliffe replied that he had once seen a valve for a steam hammer being made with the horn gates underneath, but the result was not a success. The position of the gates was reversed and then there had been no trouble at all with the casting.

Points on Skin Drying.

Mr. Trevor Richards asked what exactly was meant by skin drying and what process was adopted.

Mr. Sutcliffe replied that the mould was made and then strickled. Bars were put across and fires then put on top. Then they should be laid out to best advantage and the bottom allowed to dry, all night for preference. Referring to the use of gas and forced draught, the lecturer thought great care should be exercised to prevent burning of the mould.

Mr. Hird said with regard to skin drying, it was usual to be satisfied with leaving the mould for about one hour and asked for the lecturer's opinion. Replying to Mr. Hird, Mr. Sutcliffe said that if the mould were only half-dry it would be full of steam and would be dangerous. If necessary the top should be left off until the last moment.

Mr. Kinsman referred to an illustration which had shown an external flange and cut gear, and which had been run from the top, and asked had this casting shown any sponginess.

Mr. Sutcliffe replied there had been none whatever, and that the casting had been made in hematite iron. It had a 6-in. head and was cast on end. The farther away from the casting the runner was the better, for the dirt was kept in the runner.

Coal Dust and Blacking.

Mr. Hogg said that in referring to mixing of sands, Mr. Sutcliffe had referred to the reduction of coal dust, and, as a matter of fact, the use of blacking and coal dust was a necessary evil. He thought half of the troubles in a foundry were due to coal dust, as it created films and gases, and immediately the mould was full there was no room for gas, and if it could not get away quickly enough there was bound to be trouble and gases found just under the surface. Coal dust was not a refractory, whereas carbon was a pure refractory and did not create gases. It was a fact that one could vent with carbon, and if it were possible to make a mould of carbon alone splendid results would be achieved. Mr. Sutcliffe, in reply, said that coal dust did not get the air away from the casting, but it formed a film of gas which helped it to strip and added that blacking also greatly assisted in this manner.

A large number of lantern slides were shown and explained, and members expressed themselves as anxious for further discussion, but time did not permit this.

Mr. Hird proposed a vote of thanks, which Mr. Galletly seconded, and expressed a desire that Mr Sutcliffe should again address the Branch.

Mr. McClelland added his thanks, and reminded those present of the forthcoming visit to University of Wales. The college authorities were kindly providing refreshments. The Metallurgical Department of the College was well worth a visit, and it was hoped a large number would take this opportunity of its inspection.

European Rail Makers' Association. — It is announced that the next meeting of the Erma will be held in London on June 20, when the agenda will include the question of prices.

The Influence of Nickel on Iron-Carbon-Silicon Alloys Containing Phosphorus.*

By Arthur B. Everest, Ph.D., and Professor D. Hanson, D.Sc. (Birmingham).

Introduction.

In a recent Paper† the influence of nickel and silicon on an iron-carbon alloy containing about 3.5 per cent. of carbon was investigated, and certain conclusions were drawn thereon. Whereas the alloys used might be described as being of the same type as the cast irons, they should not be confused with the commercial cast irons, since they were made from specially pure pig-iron—American washed iron—and were prepared under conditions very different from those of commercial iron practice. Moreover, they were practically free from certain elements, notably phosphorus and manganese, which are invariably found in commercial irons.

Further experiments have now been carried out, in which phosphorus has been added to the variable factors, principally with the object of ascertaining how the effect of nickel on such alloys is altered by phosphorus.

In the first place, experiments were made on synthetic alloys simulating cast iron, using American washed iron as base, and the results are described in Section I of this Paper. Some repeat tests were afterwards made, using a commercial refined iron as base, and these are described in Section II. The work has been carried out on a laboratory scale at the University of Birmingham, all melts being made in a gas-fired crucible furnace. It should be stated that the alloys used are not necessarily commercial cast irons, and the results must be interpreted with regard to the experimental conditions under which they were obtained.

THE INFLUENCE OF NICKEL ON SYNTHETIC ALLOYS.

The American washed iron used as the basis of these experiments had a total carbon content of about 3.5 per cent. The general practice adopted was to melt the iron and add the silicon as 97 per cent. silicon; phosphorus was then added as 20 per cent. ferro-phosphorus crushed into small lumps, less than the size of a pea. This did not go into solution very easily, and it was found necessary with the higher phosphorus additions to maintain the melt at a high temperature in the furnace for about twenty minutes, stirring at intervals, before all the ferro-phosphorus was dissolved. Finally, nickel as required was added as "F" shot, as described in the previous Paper.

Composition of Alloys Cast.

Two silicon and three phosphorus concentrations were selected for the tests, as follows:—Si, 1.2 and 2.5 per cent., and P, 0.2, 0.5, and 1.2 per cent.

Irons of six compositions were thus obtained. One pot, containing 18 lbs. of metal, was made up to each composition, and four castings were made from each pot. The castings were made up to the following percentages of nickel: 0, 1, 2, and 3 per cent. The nickel additions were made between castings, as described in the report on the influence of nickel and silicon on an iron-carbon alloy. Twenty-four castings were thus obtained, giving six series with varying silicon and phosphorus, with four nickel contents in each series.

In all cases the pouring temperature was 1,320 deg. C., and no difficulty was experienced in obtaining good sound castings. Coloured skins on the castings were associated with the high-phosphorus alloys.

Form of Casting.

A step-bar casting was again employed for the tests, but the form of casting was modified, as indicated in Fig. 1, in accordance with the suggestion of Mr. J. E. Fletcher, to whom the authors' thanks are due. During casting the mould was inclined so as to place the ¼-in. step at a slightly lower level than the 1-in. step. To obtain some quantitative measurements of chill, a small cast-iron chill was moulded in at the tip of the ¼-in. step, as shown in Fig. 1. The total weight of this casting, with its runner and riser, was 4.3 lbs. The moulds were made up of green-sand and skin-dried. The castings were allowed to cool in the moulds, and when cold were knocked out, scratch brushed, and trimmed. The castings were cut across at AA and BB, the runner being scrapped. The piece between AA and BB was used for micro-examination.

EXPERIMENTAL RESULTS.

Analysis of Castings.

It has not been considered necessary to perform complete analyses of the castings, determinations being made only of the elements known to vary. Experience from previous work shows that, under the conditions of these tests, the total carbon remains constant at about 3.5 per cent., sulphur remains constant at about 0.03 per cent., and there is no manganese present. This was confirmed on castings Nos. P10 and P20, in which the amount of sulphur was found to be 0.03 and 0.029 per cent. respectively, while only a trace of manganese was present.

In Table I, recording the analysis on 1-in. sections of castings of the metal in each pot, the combined carbon is given for the casting containing no nickel. Silicon and phosphorus have each been determined on at least two castings in each series, and the figures given represent the mean value.

The agreement between the actual and the intended figures for silicon and phosphorus is reasonably good, in view of the variable loss sustained in adding these elements to small quantities of the original iron. The influence of phosphorus in raising the combined carbon is very marked in the case of the low-silicon irons. This point is significant in connection with the chill and hardness results dealt with later.

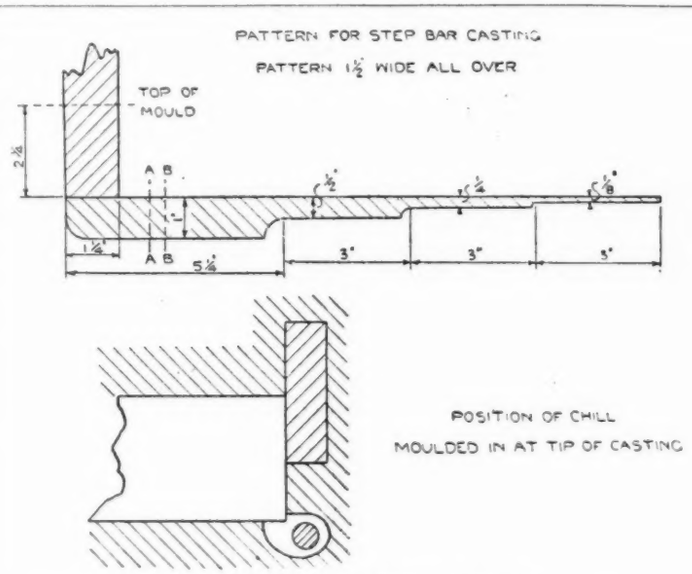


Fig. 1.—Details of Modified Step Bar.

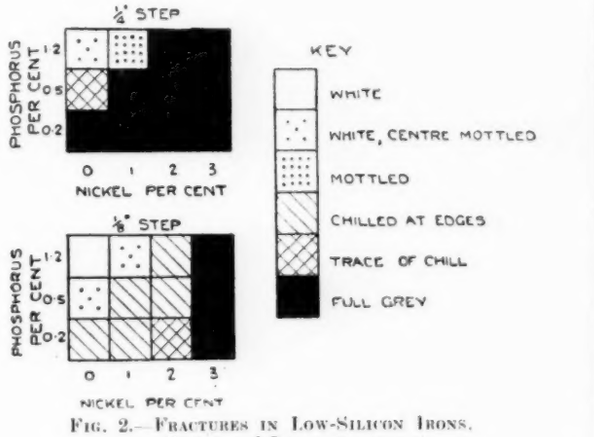


Fig. 2.—Fractures in Low-Silicon Irons. Silicon, 1.2 per cent.

Table I.—*Analysis of the Base Metal of each Series.*

	*P*1.	*P*2.	*P*3.	*P*4.	*P*5.	*P*6.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
CC	1.38	1.51	1.65	1.17	1.18	1.22
Si—intended	1.2	1.2	1.2	2.5	2.5	2.5
Si—actual ..	1.19	1.19	1.195	2.40	2.48	2.61
P—intended	0.2	0.5	1.2	0.2	0.5	1.2
P—actual ..	0.185	0.535	1.26	0.175	0.477	1.274

Nickel Determination.

Experience has shown that there is no loss of nickel when it is added to crucible melts, and the agreement between calculated and actual nickel contents can be relied on to be good. However, it was decided to check some of the nickel results, and accordingly determinations were made on the third casting of each series, that is, on the cast-

* A Paper read before the Spring Meeting of the Iron and Steel Institute.

† A. B. Everest, T. H. Turner, and D. Hanson, "The Influence of Nickel and Silicon on an Iron-Carbon Alloy," "Journal of the Iron and Steel Institute," 1927, No. II, p. 185.

ing intended to contain 2 per cent. of nickel, with the following results:—

Casting.	*P*12.	*P*22.	*P*32.	*P*42.	*P*52.	*P*62.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Nickel content ..	1.97	1.96	1.93	1.94	1.95	1.99

Fracture and Chill.

The ¼-in. and ⅛-in. steps of each casting were broken across in order to examine the variation in fracture throughout the series. The results of the examination of the fractures of the low-silicon irons are given in Fig. 2, which diagram is self-explanatory.

Where a series of grey fractures was obtained through the addition of nickel, as in the ¼-in. step of the series containing 0.2 per cent. of phosphorus, a slightly finer grain was observed with increasing nickel content.

The diagram for the ⅛-in. step emphasises the strong influence of phosphorus on the chill of the low-silicon iron, but indicates also that the presence of nickel effectively counteracts this influence. Phosphorus does not have so marked an effect in the case of the higher silicon irons

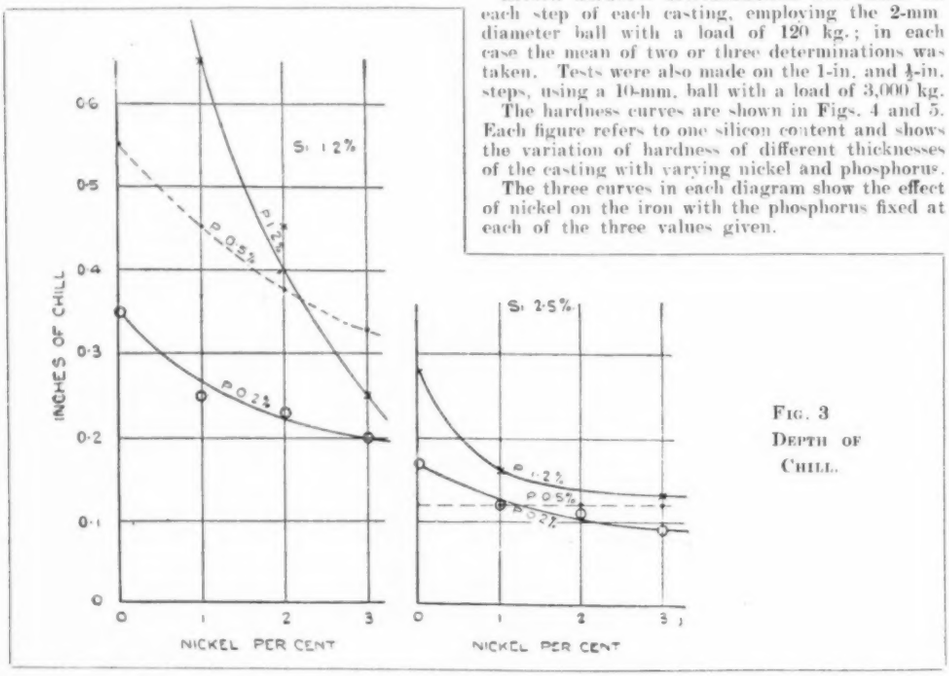


Fig. 3
Depth of Chill.

(Si 2.5 per cent.). All the fractures of the ¼-in. steps were grey, and in each series a slight but definite refining of the grain was obtained on the addition of nickel. The ⅛-in. steps showed a slight chill at the edges of the low-nickel specimens. Quantitative measurements of the chill are given in Fig. 3.

Chill measurements were made on the longitudinal fracture of the ⅛-in. step from the end of the step cast against the chill. The position of the curve for the 0.5 per cent. phosphorus irons is somewhat anomalous in the case of each silicon content. The curves are much as would be expected, and agree with the previous observations on chill depicted in Fig. 2, showing a marked increase in chill in the presence of phosphorus, this chill again being reduced by the addition of nickel.

Machinability.

Phosphorus has a very marked influence on the machinability of the irons used in these experiments, this probably being associated with the high combined carbons in the series.

*Series P*1, with 1.2 per cent. of silicon and 0.2 per cent. of phosphorus, could be readily cut with a hack-saw, nickel in this series having a slight but definite tendency to improve the machinability when 2 or 3 per cent. was present.

*Series P*2, with 1.2 per cent. of silicon and 0.5 per cent. of phosphorus, however, proved much more difficult to cut, but the higher nickel specimens showed improved machinability.

*Series P*3, with 1.2 per cent. of silicon and 1.2 per cent. of phosphorus, was quite unmachinable in the original form, and specimens from castings P30 and P31 had to be cut on the carborundum cutting-wheel. Specimens P32 and P33, however, with 2 per cent. and 3 per cent. of nickel, were capable of being cut, but with very great difficulty, on a good machine saw.

*Series P*4 *and P*5 in the higher silicon series, each with 2.5 per cent. of silicon, and containing 0.2 and 0.5 per cent. of phosphorus respectively, proved machinable, though the machinability of the latter was not good. The specimens in series P6, with 1.2 per cent. of phosphorus, had to be cut on a special machine saw, being machinable only with difficulty. In all cases nickel improved the machining qualities, though its influence was not very great. This can readily be understood, since nickel appears to have no influence on the phosphide eutectic, which by its presence impairs the machinability of the iron.

Hardness Determination.

Brinell hardness determinations were made on each step of each casting, employing the 2-mm diameter ball with a load of 120 kg.; in each case the mean of two or three determinations was taken. Tests were also made on the 1-in. and ½-in. steps, using a 10-mm. ball with a load of 3,000 kg.

The hardness curves are shown in Figs. 4 and 5. Each figure refers to one silicon content and shows the variation of hardness of different thicknesses of the casting with varying nickel and phosphorus.

The three curves in each diagram show the effect of nickel on the iron with the phosphorus fixed at each of the three values given.

In Fig. 4 it will be noticed that increasing nickel hardens the irons in each section for phosphorus contents of 0.2 per cent. and 0.5 per cent. With 1.2 per cent. of phosphorus, however, more rapid cooling in the thinner sections induces chill, which is rapidly counteracted by the addition of nickel, consequently the hardness curve for the 1.2 per cent. phosphorus irons in the thinner sections shows initially a rapid drop on the addition of nickel; but as will be noticed in the curves in Fig. 4*c*, further additions of nickel harden the iron.

The curves for the ¼-in. step are not included in this diagram, since they are similar to those of the ½-in. step, the hardness values being approximately identical.

Increasing phosphorus in the irons containing no nickel causes a rapid hardening in the first place, this effect falling off in intensity with higher additions of phosphorus, except where cooling conditions induce chill with these additions. As nickel prevents such chill, phosphorus is seen on the whole to have less action on irons with nickel than on those without.

Fig. 5 shows the corresponding curves for irons with 2.5 per cent. of silicon. This diagram shows none of the chill, indicated in Fig. 3, produced by the presence of phosphorus. Silicon is therefore as effective as nickel in counteracting the chilling influence of phosphorus. On the other hand, it will be noticed that the curves are grouped much more closely together in diagrams (*c*) and (*d*), indicating that the addition of phosphorus has little hardening action on irons cast into thin sections, and therefore subjected to rapid cooling; in fact, a study of diagram (*d*) shows that the increase in hardness between 0.5 per cent. and 1.2 per cent. of phosphorus is very small.

The rapid increase in hardness of the irons on the addition of phosphorus, indicated in diagrams (*a*) and (*b*), is accompanied by a slight increase in the combined carbon in the alloys. Consequently the slight fall in hardness seen in these

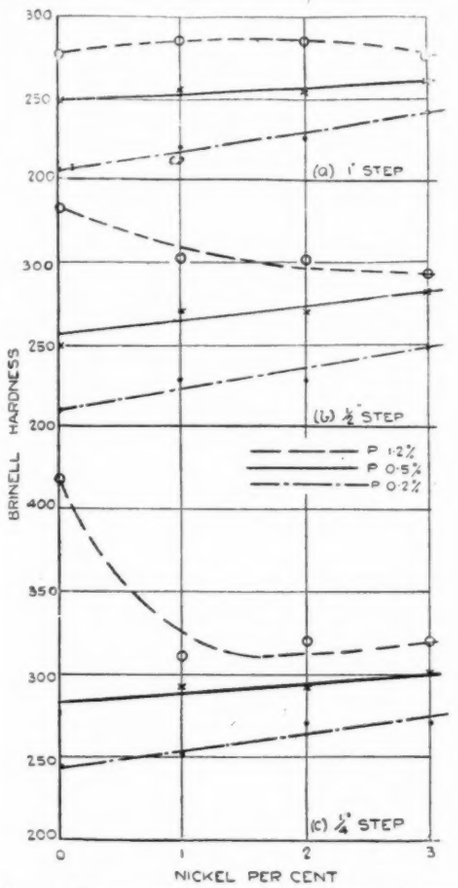


Fig. 4.—Hardness Values, with Varying Nickel and Phosphorus. Silicon, 1.2 Per Cent.

diagrams on the addition of nickel to 1.2 per cent. phosphorus irons may be due to an increase in the amount of graphite produced by the action of the nickel. On the other hand, the curves in diagrams (*c*) and (*d*) show a uniform rate of increase of hardness on the addition of nickel, irrespective of the initial phosphorus contents (that is, the *slopes* of these curves are identical), indicating that nickel is acting here solely in the matrix of the iron.

Machinability Tests on Phosphorus Series.

Tests were carried out at the works of Messrs. Belliss & Morcom, Limited, Birmingham, by kind permission of Mr. F. O. Everard, their standard drill hardness test being used.

In this test a drill of standard steel, ground to constant cutting angles in a jig, is forced into the specimen under constant load at a constant speed of revolution. The test drill is ¾-in. dia., and pressure on its nose is relieved by the prior drilling of a hole ½-in. dia., co-axial with the path of the test drill. A curve is drawn autographically, connecting depth of penetration of the drill with the number of revolutions. The drill hardness numeral is the number of revolutions of the drill required for 1-in. penetration into the specimen.

All the specimens were tested by this method,

one hole being drilled into the side of the 1-in. section, a fresh drill being used for each test.

The results are presented graphically in Fig. 6. In order to assist in the interpretation of these results, it may be stated that a normal hard iron for heavy steam-engine cylinders requires eighty revolutions of the drill.

MICROSTRUCTURE.

Influence of Phosphorus and Nickel on Graphite.

In the low-silicon irons the graphite is refined by the addition of phosphorus. With 0.2 per cent. P the graphite is medium-coarse, with 0.5 per cent. it is fine, and with 1.2 per cent. P it is in the form of very fine flakes and nodules. The influence of Ni on the graphite is modified by the presence of P.

With 0.2 per cent. P, increasing Ni produces a finer form of graphite, this being most marked with 3 per cent. of nickel. With 0.5 per cent. of P, 2 per cent. of Ni produces no change in the form or quality of the graphite. With 3 per cent. of Ni, however, the graphite appears to be somewhat coarsened. With 1.2 per cent. of P the effect of 1 per cent. and 2 per cent. of Ni is to produce a greater quantity and coarser form of graphite; with 3 per cent. of nickel the form is somewhat refined.

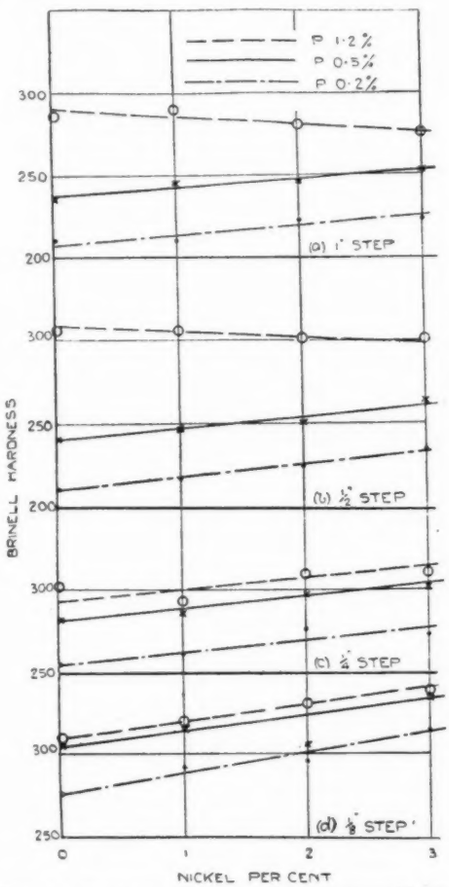


FIG. 5.—HARDNESS VALUES, WITH VARYING NICKEL AND PHOSPHORUS. SILICON, 2.5 PER CENT.

In connection with these results it is important to remember that the combined carbons for these irons are 1.38, 1.51, and 1.65 per cent. respectively.

As would be expected, higher Si masks the effects produced by P, and, in consequence, the influence of Ni on the graphite is less pronounced in the 2.5 per cent. Si irons. Throughout, the graphite is moderately coarse, and in general occurs in the whorl or rosette form. In series 5 and 6 it was noted that 3 per cent. of nickel gives a finer graphite form, but lower percentages appear to have little or no effect.

Etched Specimens.—Specimens were etched with a 1.5 per cent. solution of nitric acid in alcohol. In all specimens a phosphide network more or less marked was seen by the naked eye (Fig. 11). Experiments have been conducted with special reagents (modifications of Stead's reagent), with a view to etching the specimens deeply to reveal this network more clearly. These experiments, however, have led to no very satisfactory result; in the case of the irons under investigation, a carbide network exists owing to the high combined carbon present, and this masks the phosphide network to some extent.

Observations on the network structure revealed by ordinary etching methods show that, with the lower percentages of phosphorus, nickel has no appreciable influence on the size of the structure. With 1.2 per cent. P, however, Ni produces a very marked refining of the network. With 1.2 per cent. Si and 3 per cent. Ni the mean diameter of the cells enclosed by the network is only one-third of that without nickel.

Typical microstructures of irons with each phosphorus content are shown in Figs. 12, 13 and 14; nickel has no apparent influence on the form or quantity of the phosphide eutectic.

In all series, nickel produces a finer structure in the pearlite, rendering it in general finely granular or sorbitic, but this effect is more pronounced in the low-phosphorus irons, high phosphorus appearing to mask it. This will be illustrated later.

Again, the development of acicular pro-eutectoid cementite is seen (Fig. 15) in two specimens—P12 and P13—containing 2 per cent. and 3 per cent. of nickel in an iron with 1.2 per cent. of silicon and 0.2 per cent. of phosphorus; this effect is similar to that seen in the corresponding iron with no phosphorus. With 0.5 per cent. of phosphorus, 3 per cent. of nickel has not produced the same effect, nor is acicular cementite seen in any of the other specimens; this clearly indicates that phosphorus masks the effect of nickel, confirming the statement of Houston* that more nickel is required to produce a given effect in the presence of high phosphorus than of low phosphorus.

It will be noticed from Table I that throughout this series of tests the combined carbon in the specimens is very high (between 1.17 and 1.65 per cent.). Part of this combined carbon is undoubtedly associated with the phosphide areas as ternary eutectic† and as excess cementite in this eutectic (Fig. 16). But this will account for only a small part of the combined carbon. Consequently there must be a considerable quantity of excess carbide in the pearlite. Examination of the specimens with no nickel at high powers reveals in most cases granular cementite in the pearlite.

It has already been shown that in series P1 the addition of nickel renders this carbide acicular; in the other series, however, it is found that nickel throws the excess carbide to the grain boundaries in a granular form, while it renders the grain centre uniformly sorbitic (Fig. 17). This effect is more clearly marked in the higher silicon irons, and is clearly seen in series P4. Three per cent. of nickel appears to produce in this case excess carbide in a finer form, giving a fine granular structure in the ground-mass of iron.

The higher silicon series calls for little further comment. The influence of nickel on the pearlite and on the graphite has already been discussed. It is seen that there is no marked change in the form of the phosphide areas, although it has been noted elsewhere that in the higher phosphorus series there is a refining in the size of the phosphide network.

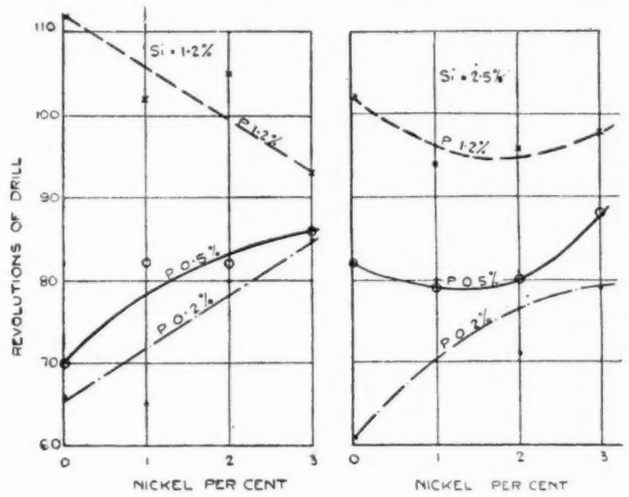


FIG. 6.—DRILL HARDNESS TESTS.

Summary of Part I.

The influence of nickel up to 3 per cent. on synthetic irons containing 1.2 and 2.5 per cent. of silicon, with phosphorus varying between 0.2 and 1.2 per cent. has been studied. Phosphorus renders the low-silicon iron very susceptible to chill, 1.2 per cent. producing a white fracture in ⅛-in. sections of the iron. The addition of small quantities of nickel restores the grey fracture to this iron in all sections by counteracting this tendency to chill.

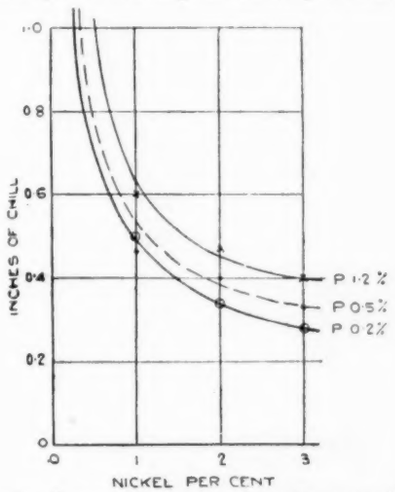


FIG. 7.—REFINED IRON. DEPTH OF CHILL ON ⅛-IN. STEP.

Phosphorus has less effect on the chill of the high-silicon iron, indicating that silicon, like nickel, opposes the effect of phosphorus. Nickel has a refining action on the size of the grain in the grey fractures of the iron. A phosphorus content of 0.5 per cent. renders these irons difficult to machine, and 1.2 per cent. renders the low-silicon iron unmachinable and the high-silicon iron almost so.

Nickel has little influence on the machinability in the presence of these amounts of phosphorus.

† "Iron and Coal Trades Review," 1927, vol. cxiv, p. 391.

* H. Jungbluth and H. Gummert, "On the Influence of Casting Temperature and Annealing on the Extent and Form of Occurrence of the Phosphide Eutectic," "Kruppsche Monatshafte," 1926, vol. vii, p. 41.

This is easily understood, assuming that the unmachinability is due entirely to the presence of the hard phosphide eutectic, for nickel has little or no influence on the form or distribution of this

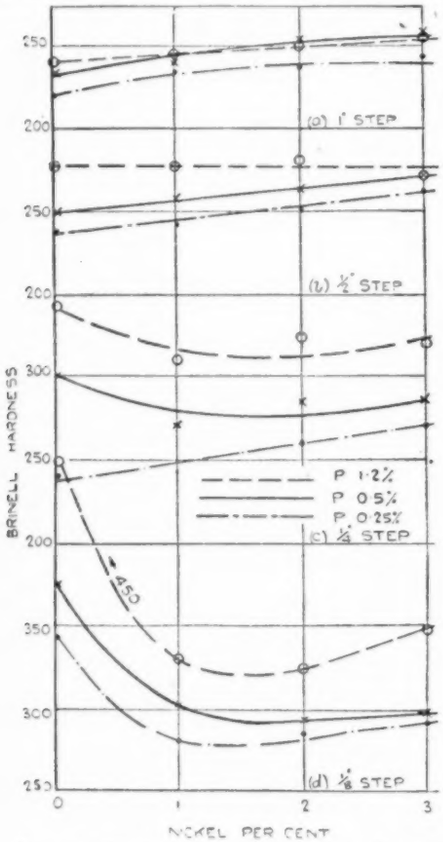


Fig. 8.—Refined Iron. Hardness Values with Varying Nickel and Phosphorus.

eutectic. The influence of phosphorus is the more pronounced owing to the high combined carbon in the irons investigated.

Phosphorus hardens both the low- and high-silicon irons. In the former case phosphorus promotes chilling in the thin sections, and this chill is counteracted by the addition of nickel. Under all other conditions nickel exerts its normal hardening action on the matrix of the iron. Phosphorus reduces the amount of graphite in the low-silicon iron; nickel, on the other hand, will regraphitise this iron. In all irons completely graphitised, nickel will render the graphite form finer.

Nickel acts on the matrix of the iron, rendering the pearlite finely granular or sorbitic. Proeutectoid cementite is rendered acicular only in the case of the low-silicon, low-phosphorus iron.

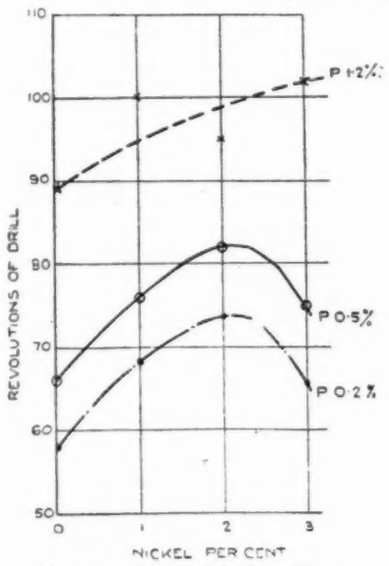


Fig. 9.—Refined Iron. Drill Hardness Tests.

Higher phosphorus appears to mask the influence of nickel on the carbide, and also on the pearlite to some extent, both being rendered finely granular on the addition of nickel to higher phosphorus irons.

(To be continued.)

Errata.

In our last issue, in the article on chilled iron rolls the magnification for Fig. 7, page 296, should be × 300, whilst the headline in column 2, page 297, should read "Scientific Control Essential to Prosperity."

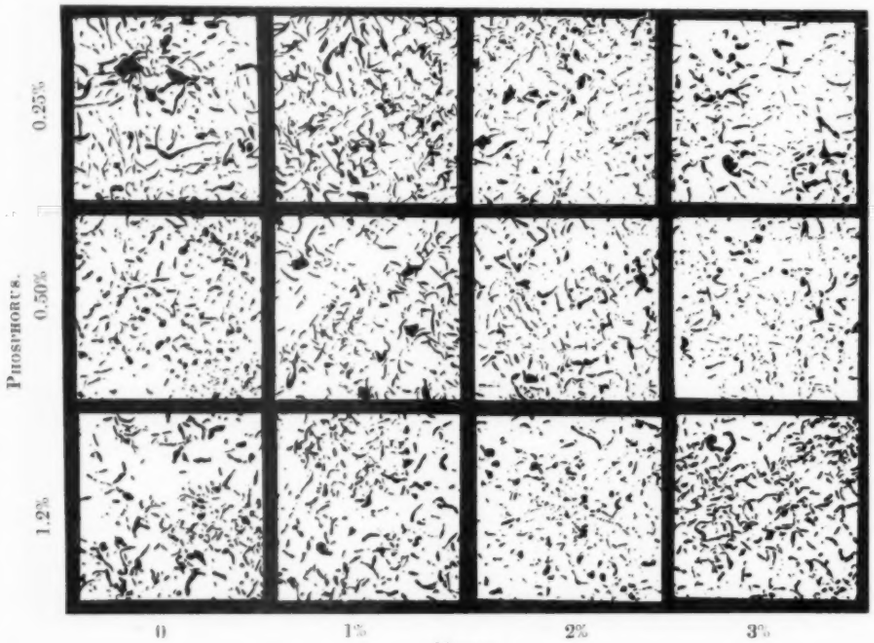


Fig. 10.—Graphite with Varying Phosphorus and Nickel. × 25.

The New President of the F.T.E.S.A

As previously announced, Mr. Harry Winterton was, at the annual meeting of the Foundry Trades Equipment and Supplies Association, Limited, elected to the chair in succession to Mr. V. C. Faulkner. Mr. Winterton is the chairman and managing director of Messrs. William Cummings, Limited, of Glasgow, Falkirk, Chesterfield, Deepfields and elsewhere, where they carry on a large business as manufacturers of coal dust, foundry blackings, and the like. Mr. Winterton has, since his appointment in 1923 as chairman of this concern, introduced a profit sharing scheme for the employees, in addition to a non-contributory pension scheme. Moreover, the firm have carried through—at least so far as the Chesterfield works are concerned—a splendid housing scheme for the operatives.

Mr. H. Winterton, the recently elected President of the Foundry Trades Equipment and Supplies Association, Limited.

Mr. Winterton is also one of the oldest members of the Institute of British Foundrymen, joining in 1905, and is during the present session vice-president of the Scottish section. A further activity is the Refractories Association, and in 1926 he had the honour of representing both that body and the "Equipment" Association at the 2nd International Foundrymen's Congress, held in Detroit City. We congratulate Mr. Winterton on his appointment, and feel sure that progress will be continued under his chairmanship.

Buchanan Medals Inaugurated.

At a meeting of the General Council of the Institute of British Foundrymen, held in Manchester on Saturday last, it was announced that the directors of a firm, who wish to remain anonymous, have offered to present silver medals each year to the various junior sections of the Institute for competition among the members of each section. These medals are in memory of the late Mr. Robert Buchanan, one of the early pioneers of the Institute of British Foundrymen and one of the best known foundrymen in the country, and the medals will be known as the "Buchanan Medals." The Council of the Institute have very gratefully accepted the offer of the donors, and it is expected that arrangements with regard to the governing of the awards will be made very shortly.

Blast-Furnace Practice in Natal.*

By J. E. Holgate, B.Sc., and R. R. F. Walton, Newcastle, Natal.

Introduction.

This Paper concerns principally the blast-furnace plant situated at Newcastle, Natal, owned by the Union Steel Corporation (of S.A.), Limited, of which the authors are manager and chief chemist respectively. Its object is to describe briefly the development and pioneering difficulties connected with the pig-iron industry in South Africa, followed by observations on the character and distribution of raw materials in the Province of Natal and the actual working results of operation over a period of about 15½ months.

As there is only one iron blast furnace in the whole continent of Africa at the present time, it is interesting to review the main events which have led up to the commercial production of pig-iron in South Africa, where the white population does not exceed the combined populations of Manchester and Birmingham. It will be apparent that outputs of iron and steel must, in the first stage, be modest, and then progress as subsidiary industries are established.

The Union Steel Corporation commenced operations in 1913 at Vereeniging, Transvaal, for the manufacture of steel products from ingots made from smelted steel scrap. For several years previously the railways and mines had been inconvenienced by the enormous accumulations of steel scrap, the exportation of which did not pay on account of the long distances to the coast. After long negotiations with many parties, an agreement was entered into for a period of 16 years, whereby the railways supplied their scrap at a low price to the new company, which in its turn was guaranteed the orders for such steel products as the Corporation could produce, with due consideration to quality and time of delivery. Owing to difficulties in obtaining new plant, etc., during the war period, it was several years before the Vereeniging Steelworks were established on a paying basis, but eventually a regular and substantial tonnage of rails, bars, sections, and steel castings was forthcoming, and was quickly absorbed by the railways and mines.

In recent years, however, the supply of suitable scrap has become progressively less than the consumption, and it became obvious that a sound steel industry could not be expanded on a scrap basis only. The manufacture of pig-iron on a commercial scale thus became an essential factor. In the meantime, a blast-furnace plant was under construction at Newcastle by a new company called the Newcastle Iron and Steel Company. Owing to lack of capital the plant could not be finished, and arrangements were made to absorb this company into the Union Steel Corporation, thus consolidating the iron and steel interests to the mutual benefit of both companies.

For the pioneer work of laying the foundation of the pig-iron industry in Natal great credit is due to Mr. J. K. Eaton, who sank a large amount of his private capital in the original Newcastle concern, as he was convinced that the natural resources of Natal would assure the future prosperity of the industry. He chose Newcastle as the site for the plant on account of its excellent water supply; the carriage of ore and coke to that town was slightly higher than to the ideal geographical centre of the ore and coking-coal deposits about 40 miles away, but ample water facilities did not appear to exist at the latter place.

Under the direction of Mr. A. K. Reese, consulting engineer to the Corporation, the plant was thoroughly overhauled. Necessary additions were made in the way of improved boiler and water-service equipment, etc., while the hearth and bosh of the furnace were enlarged and redesigned on more modern lines. Many other details required serious attention, and after an organisation for operation was secured and trained, the furnace was blown in by Mr. Reese on June 18, 1926. The primary object of production was, of course, to supply the necessary basic pig-iron for replacing at least 50 per cent. of the scrap then being used in the open-hearth furnaces at the Vereeniging Steelworks. Foundry iron would supply the foundries of the Union, replacing the imported brands, and at a price to encourage the more extensive use of pig-iron, again in place of scrap, and so promote the more rapid extension of the engineering industries generally within the Union. To this end the Government had previously passed a Bounty Act to encourage the iron and steel industry in the country, whereby a substantial bounty was granted, decreasing in stages as the industry gradually became self-supporting. This was considered to be a better policy than imposing a tariff on imported iron or steel.

* A Paper read before the Spring Meeting of the Iron and Steel Institute.

RAW MATERIALS.

Iron Ores of Northern Natal.

These ores occur in the Ecca series of the Karoo system, corresponding to the lower Permian rocks of Europe, and in which the coal measures are found. This series is divided into three natural groups:—(1 and 3) The upper and lower Ecca consist largely of black to blue fine sedimentary shales not less than 600 ft. in thickness, and (2) the middle Ecca contains the coal measures and ore seams. It consists of sandstones, grits and shales and is not less than 1,250 ft. thick in the middle of the area. The rocks are nearly horizontal, undulating with a general dip SSW. Thin beds of calcareous sandstone are met with, containing about 40 per cent. SiO_2 and 45 per cent. $CaCO_3$. The ore beds occur about 120 ft. below the main coal seams, and may be seen over a large area west of Dundee. On the same horizon ore is found in the Utrecht district.

The main source of the iron ore supply is at Prestwick, about 10 miles NE. of Dundee and 58 miles by rail from Newcastle. This has been proved to be an extensive bed lying very slightly off the horizontal, with occasional slight undulations, through a long ridge of hills. The outcrops round this bed may be traced for several miles, and in 1925 it was decided to open up on the Prestwick farm, where the outcrop ore appeared to show the greatest expanse. Here it was easily uncovered and served as the original supply of ore for the blast furnace (about 30,000 tons). This outcrop ore consisted of a hydrated oxide of iron of the following average analysis:—

Oxide Outcrop Ore (Prestwick).—Iron, 49.25; SiO_2, 8.00; Al_2O_3, 4.20; CaO, 0.50; MgO, 0.45; Mn, 0.43; P, 0.15; S, 0.04; and Loss on Ignition, 15.00 per cent.

The Union Steel Corporation constructed a railway line about 7 miles in length to connect with Tayside Station, at a cost of over £25,000, and established a properly equipped mining camp, as there was every indication that the area would yield a permanent supply of ore.

In the meantime an adit was driven into the hill which contained the main body of ore, and arrangements were made for intensive development. Within 30 ft. of the surface the deposit was found to consist of a uniform body of ferrous carbonate, black in colour and very dense. The bed varies in thickness from 3 ft. to over 10 ft., but the line of development lies now in the direction of the thicker portion, which appears to be unlimited in extent. Above the carbonate ore there exists a seam of shale about 10 in. to 12 in. thick covered by another thin band of anthracite coal 6 in. thick. The roof is a very sound sandstone and requires no timbering.

The ore has been found to be very uniform in analysis in all directions, Table I giving the average analyses at different points.

Under furnace operation a very important feature of this large ore body is the fact that it contains about 5 per cent. of free carbon in a very fine state of division. This renders the ore self-calcining and also promotes coke economy in the furnace, where it is easily reduced, partly through the disintegrating effect of heat on the laminated lumps of ore.

This ore may be classed geologically as a siderite of sedimentary formation, and it is doubtful if another such body of similar purity and uniformity has yet been exposed in any other part of the world. The outcrop ore is softer in character, being hydrated oxide of iron of a limonite character, obviously produced by prolonged atmospheric action on the originally exposed carbonate. It is very interesting to observe at the mine how the light brown oxide gradually merges through the intermediate stages into the primary stage of dense black carbonate underground.

The main driving adit extends now close on to 2,000 ft. into the hill, and other adits are being developed with mechanical haulage to enable large tonnages to be handled. Coal-mining principles have been introduced, utilising the pillar-and-stall system. At the present time about 300,000 tons of pure ore have been blocked out in pillars, the average thickness of the bed being in the neighbourhood of 6 ft. Even supposing the whole ore body only averages 2 ft. 6 in. in thickness, it is computed that the properties over which the Union Steel Corporation hold the rights contain not less than 60,000,000 tons of ore. This figure has been endorsed by Mr. F. A. Steart, a well-known mining engineer and geologist in Natal. Assuming that only 10 million tons are available or capable of economical extraction, this quantity would be sufficient for an output of 150,000 tons of pig-iron annually over a period of about 27 years.

Other Deposits.

Although Natal has not been thoroughly prospected for iron ore deposits, the following are of interest owing to their quality, and are an encouragement for further prospecting.

Rodell's Farm.—This ore is a surface deposit of hydrated oxide of iron situated about 8 miles from the Prestwick deposit and near the railway. The overburden varies from a few inches to 2 ft., and the ore varies from 18 in. to 36 in. in thickness. The total quantity in sight is estimated at about 200,000 tons. Approximately 22,000 tons have been smelted at Newcastle in admixture with Prestwick carbonate ore, with satisfactory results.

A typical analysis of Rodell ore is as follows:

	Per cent.
Iron	50.05
Silica	5.95
Alumina	4.00
Lime	Trace
Magnesia	,,
Manganese	0.57
Phosphorus	0.081
Sulphur	0.025
Moisture	10.00

This small deposit was very useful in the early stages while development was proceeding at Prestwick, as the ore is loaded into trucks very cheaply.

TABLE I.—*Analyses of Prestwick Carbonate Ore.*

Date.	Iron. Per cent.	SiO_2. Per cent.	Al_2O_3. Per cent.	CaO. Per cent.	MgO. Per cent.	Mn. Per cent.	P. Per cent.	S. Per cent.	Loss on Ignition. Per cent.
April, 1926	42.80	5.50	2.60	0.75	0.65	0.44	0.14	0.14	28.10
Oct., 1926	40.28	5.15	2.40	0.70	0.20	0.45	0.13	0.18	33.35
Nov., 1926	41.02	4.45	2.55	0.70	0.30	0.50	0.12	0.15	31.90
Jan., 1927	40.08	5.60	3.00	0.80	0.30	0.49	0.13	0.15	31.65
Oct., 1927	41.20	6.30	2.70	0.50	0.20	0.56	0.14	0.14	30.90

Hazledene.—This property is situated about 10 miles east of Dundee and 7 miles from the railway. The ore is a massive hematite rich in iron and low in phosphorus. So far as is now known the extent is small, probably about 70,000 tons. It appears to be a surface deposit averaging 5 ft.

in thickness, and can be worked open-cast, the overburden being only 1 or 2 ft. A few hundred tons of this ore have been delivered on rail by ox-wagon, and smelted at Newcastle. The average analysis of these deliveries was as follows:

	Per cent.
Iron	63.45
Silica	1.85
Alumina	0.35
Lime	0.45
Magnesia	0.35
Manganese	0.30
Phosphorus	0.03
Sulphur	0.05
Loss on ignition	4.00

Dick's Farm (near Utrecht, about 20 miles from Newcastle).—This is another small surface deposit of soft brownish-red ore which for some years has been worked in a desultory fashion for the manufacture of oxide paint. Samples of harder ore picked out analysed as follows:

	Per cent.
Iron	55.10
Silica	8.75
Alumina	2.95
Lime	0.85
Magnesia	0.44
Phosphorus	0.12
Sulphur	0.02
Loss on ignition	7.35

Palmyra. This is a curious deposit of calcareous ore situated near the Dundee-Vryheid Railway line, 10 miles east of Prestwick. It is farther under the surface, and boreholes have proved a quantity of approximately 100,000 tons. The analysis is as follows:

	Per cent.
Iron	28.20
Silica	0.98
Alumina	0.85
Lime	25.10
Magnesia	6.45
Manganese	0.61
Phosphorus	0.13

If the quantity should prove greater, it will be worth while opening out and using it with the Prestwick ore in place of limestone or dolomite as a flux.

Cokes.

Whatever the quality of the ore may be, blast-furnacemen fully recognise that the successful operation of a blast furnace depends, in a large degree, on the satisfactory quality of the fuel available for smelting. Up to the present time the Union Steel Corporation have not been in a position to manufacture their own coke, but have depended on the enterprise of certain colliery companies in Natal to meet their requirements. Speaking generally, these collieries have tackled the problem in a very thorough manner, and by establishing and maintaining a good quality of coke have assisted in a large way in the establishment of the pig-iron industry in this province on a sound commercial basis. The price, however, is still too high (average, 21s. 6d. at the ovens), and it will be necessary to secure a material reduction in order to bring down the cost of pig-iron to a level profitable for export in the world's markets. In the near future it is expected that the Corporation will have a greater control over coke manufacture, either by a closer working arrangement with the present producers, or by erecting a coke-oven plant at the most economical point for the selection of coking coals and saving in railages.

Northern Natal possesses the only extensive areas of coking coal in South Africa, so far as is known at present. The Transvaal has rich coal-bearing areas, but mostly of a non-coking character. A number of collieries in the Transvaal have demonstrated by experiment that a coking coal exists, but in these instances it has been found that the coking coal only consists of a certain thin portion of the seam. For extraction this would involve selective mining. Up to the present one cannot see a commercial proposition in coke manufacture there, particularly as the average ash in Transvaal coal is higher than that in Natal coal.

The two areas in Natal which have been exploited on a large scale for coking coal are round Dundee and Vryheid. In the former the Corporation is served by the Dundee Coal Company, who operate a battery of Coppée by-product ovens at Waschbank, about 50 miles from Newcastle.

Average Analysis of Waschbank Coke (By-Product).

	Per cent.	Ash Analysis.	Per cent.
Carbon	86.54	Silica	46.20
Ash	11.05	Alumina	39.50
Sulphur	1.01	Lime	2.10
Moisture	1.40	Magnesia	0.95
Phosphorus	0.095	Ferric oxide	8.30

This coke, made from coal containing about 18 per cent. of volatiles, is very strong and dense, and the question of breeze does not arise. On the whole, it has worked satisfactorily as a blast-furnace fuel.

Vryheid district produces beehive coke at several plants situated at different collieries round their coal-field. The average distance from Newcastle is probably 75 miles.

Average Analysis of Vryheid Coke (Beehive).

	Per cent.	Ash Analysis.	Per cent.
Carbon	86.59	Silica	49.00
Ash	11.95	Alumina	35.75
Sulphur	0.75	Lime	1.10
Moisture	0.68	Magnesia	1.09
Phosphorus	0.0055	Ferric oxide	9.45

The coals in the Vryheid district are eminently suitable for coke-making, and contain a somewhat higher percentage of volatiles as compared with Dundee. The beehive coke is of excellent quality, with a very low density combined with adequate mechanical strength. The yield from these ovens varies from 50 to 60 per cent., and the gases are, of course, a waste product. The ash is a little higher than the Dundee by-product coke, where the yield is probably 65 to 70 per cent., but the sulphur content is considerably lower. The phosphorus content is almost negligible, which would be an important asset in the manufacture of hematite iron from low-phosphorus ores, should this prove feasible at any time.

Comparison of Dundee (By-Product) and Vryheid Cokes.—It has been established that the rate of combustion of the beehive coke is considerably greater than that of Dundee by-product coke, due entirely to its increased porosity. The mixture used at the furnace is about 50/50, which has proved very satisfactory, and full outputs of pig-iron have been maintained with this proportion. With a preponderance of Dundee coke of denser character the furnace undoubtedly slows up through the decreased rate of combustion. Improvements, however, are being effected at the ovens, at the Corporation's suggestion, by charging the low volatile coal without compression. This, of course, may retard the output of the present coke-ovens, but for blast-furnace requirements it is essential to avoid excessive density, although for cupola practice it is often a good feature.

The low sulphur content of the Vryheid coke enables the furnace to carry a desulphurising slag with a low ratio of lime to silica. This naturally results in a saving in the cost of flux per ton of pig. It has been estimated that a reduction in the coke sulphur from 1 per cent. to 0.75 per cent. results in a saving of flux of 9d. per ton. That is, whereas a $\frac{\text{lime}}{\text{silica}}$ ratio of 1.5 in the slag must be carried in the former case, it is possible to produce a similar iron with a 1.4 ratio in the case of all-Vryheid coke.

Fluxes.

The furnace was started up and ran for about six months on limestone obtained from the Taungs deposit in Bechuanaland, the distance from Newcastle being close on 400 miles. The stone was of excellent quality but expensive, owing to the long railage. Subsequently experiments were made with a dolomite obtained from Natal Spruit, near Johannesburg, 180 miles distant, where a large deposit was exposed. Results were quite successful and a large contract was entered into, thus saving about 10s. per ton of flux.

The average analyses of these stones are as follows:

	Taungs Limestone.	Natal Spruit Dolomite.
	Per cent.	Per cent.
Lime	54.30	28.60
Magnesia	0.35	18.75
Silica	1.45	1.75
Ferric oxide	0.25	—
Ferrous oxide	—	2.55
Alumina	0.15	0.25
Manganous oxide	—	2.60
Sulphur	Trace	0.003
Phosphorus	0.003	0.004
Loss on ignition	42.25	45.90

The presence of 2.60 per cent. of MnO in the dolomite is an interesting feature, and the manganese appears to counteract any decreased desulphurising effect of the MgO in the resulting slag. Without the addition of manganese ore, the manganese in our basic pig can be maintained at about 1.5 per cent., which is found to be a considerable benefit in the open-hearth.

Air.

As this is the raw material used in the largest quantity, it is perhaps worth while mentioning the two main features regarding it:

(1) The altitude of Newcastle being 4,000 ft. above sea-level, it follows that allowance must be made in the design of any blowing unit to give the required volume at N.T.P. It is necessary to increase the revolutions of the reciprocating blowing engines about 11.3 per cent. to give the same weight of oxygen per minute as would be obtained at sea-level.

(2) Although temperatures vary from 100 deg. F. maximum down to 22 deg. F. minimum, the air on the whole is fairly dry, the average moisture content being about 4.25 grains per cub. ft. in spite of very hot days in the summer, with frequent heavy thunderstorms.

DESCRIPTION OF PLANT.

The blast furnace has the following dimensions:

Height	70 ft. 0 in.
Bosh diameter	14 ft. 5 in.
Hearth	10 ft. 0 in.
Bosh angle	78 deg.
Throat diameter	10 ft. 0 in.
Bell	6 ft. 0 in.
No. of tuyeres	8 (5½ in. diam.)

The hearth is fitted with a steel-plated jacket with external water spray, while the bosh cone is cooled in a similar manner. The tuyere belt is fitted with three rows of copper cooling plates which have proved very efficient. The capacity of the furnace is about 150 tons per day.

The filling arrangements consist of a long trestle gantry with concrete bunkers from which the different materials are drawn into the standard type of barrows for hand-charging. These barrows are drawn up by a steam-driven, double-cage hoist, and dumped into an ordinary type of bell and hopper. With cheap native labour available it was not considered advisable at this first stage to equip the furnace with a mechanical charger for the comparatively small output.

The iron is all cast in sand, the pig bed being traversed by a Morris crane of 10 tons capacity, which carries the beds of iron to a Lamberton pig-breaking machine from which the broken iron is discharged into wagons for despatch or stock. An extension of the pig bed gantry also deals with a considerable amount of stock iron in combs.

The blast is supplied by two vertical reciprocating steam-driven blowing engines, compounded and equipped with an efficient condensing plant. Each engine is capable of delivering about 22,000 cub. ft. of free air per minute up to 12 lb. pressure at 60 r.p.m. Walker light disc air valves were fitted on the blowing cylinders after scrapping the original valves, which were unsatisfactory. These engines were originally used on the Rand gold mines as compressors, and were converted for our purpose by substituting larger air cylinders. Each engine is fitted with two air cylinders 60 in. × 60 in. Engine speeds vary from 50 to 60 r.p.m., according to requirements.

It is proposed eventually to install a modern turbo-blower, but so far the existing engines meet all requirements

There are four Cowper stoves (one erected since blowing in), 70 ft. × 20 ft., with 7½-in. checkers, giving a heating surface of 42,000 sq. ft. per stove. The gas-burners are similar to the Bradshaw type with a central air-tube, while secondary air can be admitted through two side regulators. Blast temperatures exceeding 1,400 deg. F. can be obtained, while a cold blast by-pass is provided for equalising or regulating the blast temperature on the furnace.

The boiler plant consists of five gas-fired Babcock & Wilcox units, each of 250 h.p., and generating steam at 160 lbs. pressure. Special gas-burners were designed by Mr. A. K. Reese, which give a very intimate mixture of gas and air, while efficient combustion is always maintained by allowing the flame to pass through a checker firebrick wall in front of the tubes. This keeps incandescent and has proved a useful feature.

Great care was taken before starting to ensure a satisfactory water service, which would, if necessary, cope with a possible increase in the plant. The River Incandu, providing a never-failing supply of good soft water, is situated 2,000 ft. from the engine room, which is roughly 40 ft. above the mean level of the river. The pump house at the river contains three Sulzer centrifugal pumps, each capable of delivering 1,500 gallons per minute through a 24-in. Hume reinforced concrete pipe into a sump at the engine room. The pump house can be hermetically sealed, with access only through the roof. This is necessary in case of heavy floods, when the river has been known to rise 18 ft. in a day. At the engine-room sump the water is distributed to the overhead furnace tank and to the various condensers by further centrifugal pumps. The return water then flows by gravity into the river again at a slightly higher point, so that a large reservoir with cooling towers is not necessary. For emergency use and for maintaining a constant level in the engine-house sump there is a pond on the property with a reserve content of 2 million gallons of water, which can feed the system at any time. About 3½ million gallons of water are circulated through the works each day.

Foundry Department.

The electrical power for motors and lighting is generated by a vertical triple expansion Bellis and Morcom 500 kw., 500 volts d.c. set. The lighting system is supplied through a balancer set at 250 volts. There is a spare generator as a stand-by. As there is a surplus amount of blast-furnace gas it has been possible to drive the electrical machinery for an adjacent brickworks; also, at an early date it is expected to be possible to light the town of Newcastle and supply power to private consumers.

The slag from the furnace is removed in Dewhurst self-tipping ladles of 10 tons capacity each. This material has been found to make excellent railway ballast, and is also used in road-making and for concrete. At a future date the manufacture of cement on a large scale from the granulated slag is contemplated. The works is equipped with a large engineering workshop and an up-to-date laboratory, which have been important factors in the successful operation of the furnace. A small foundry is attached to the plant for the manufacture of railway chairs, utilising native labour. Extensions are being made, and it is expected to meet all requirements of the railways in the near future.

NOTES ON OPERATION OF BLAST-FURNACE PLANT.

Blowing-In.—After the completion of all plant details, the blowing-in was effected in June, 1926, the charging being as follows:—First, 10,000 lbs. of coke was placed in the hearth, followed by timber filling to a point 2 ft. above the tuyeres. Above this 36,000 lbs. of coke blank was charged, followed by 54,000 lbs. of coke blank with the limestone necessary for the two sets of coke. The ore round commenced at 600 lbs., the coke round weighing 5,400 lbs. throughout, and, on filling the furnace, the ore had reached 5,400 lbs., or roughly one-half of the normal burden.

The following are the actual analyses of the materials used:

Coke: Waschbank By-Product.

	Per cent.
Silica	5.22
Alumina	4.17
Lime and Magnesia	0.56
Ash	11.5

Ore: All Prestwick Outcrop.

	Per cent.
Iron	48.50
Silica	7.00
Alumina	3.65
Lime and magnesia	0.75

Limestone: Taungs.

	Per cent.
Silica	1.65
Alumina	0.18
Lime	53.95

As the stoves were cold, extra fuel was required to allow for any delay in heating up the stoves by gas, while naturally a little more margin was allowed in the primary stages of blowing-in than would be necessary at a corresponding plant in England, owing to lack of previous experience of South African materials and the comparatively raw staff who were to assist in the operations. It may be mentioned here that the management could only depend on one experienced furnaceman on each shift, namely, the foremen, who were imported. The native Zulu labour had still to be tested, but eventually proved very adaptable and hard working.

The furnace was started in the American fashion, using 5-in. tuyeres and applying light blast, without any interval for natural drafting. A small cast of foundry iron was obtained from the tapping hole within 24 hours, and the normal process was then followed, with successive increments of burden. The early casts showed 4 to 5 per cent. of silicon, and the furnace was maintained on good foundry iron with 2.5 to 3 per cent. of silicon for 10 days or so until a definite routine was established, when a basic iron burden was put on.

No difficulty was experienced in the filling and charging operations; the natives were well coached and quickly grasped the fundamental ideas, and an orderly system was soon developed. For a temporary period extra white supervision was necessary in connection with the operation of the hoist and distribution on the bell, etc., but this was soon withdrawn and the native organisation came under the shift foreman direct.

More difficulty was experienced on the pig bed for the first week or two, as the natives, whose mentality in many respects resembles that of children, ran away at the first sight of molten slag and iron. Many changes had to be made, but they gradually became accustomed to the new conditions, and, by the exercise of patience and tact on the part of the management, became very efficient workers. As most of the Zulus can only work a maximum of six months in the year away from their farms, it became necessary to be continually training new native boys to take the place of those departing. This naturally threw more responsibility on the few leading white men in charge of different sections.

Within 14 days the furnace had attained an output of about 125 tons per day, and operating results proved quite satisfactory on the whole. Subsequently the output reached the scheduled capacity of the furnace, that is, 150 tons. In view of the restricted outlet for the product, however, it has not been considered advisable to maintain the maximum output of the furnace, so that the 5-in. tuyeres have remained. These will be replaced by 5½-in. tuyeres when occasion demands.

The first year's campaign has not run entirely smoothly, owing to many varying conditions, such as (1) variations in the quality of the ore through the progressive phases of development at the mine, (2) mechanical troubles with blowing engines, which were, however, satisfactorily overcome; (3) continuous training of labour, necessitating careful selection and rejection, with the main object of reducing labour costs to a minimum; (4) climatic changes, including frequent tropical downpours of rain, with occasional cloudbursts in the summer-time.

The campaign lasted about 15 months, during which period 56,209 tons of iron were made, the output being restricted as mentioned above. The furnace was closed down on October 1, 1927, owing to the excess of stocks of pig-iron, but it will resume operation after a period of 8 or 9 months. It is then anticipated that the full capacity of the furnace will be required for a more prolonged period to meet the increasing demands for pig-iron at the steelworks and foundries.

Smelting of Native Ores.

For the first few months it was necessary to use practically all the oxidised outcrop from Prestwick, as described under raw materials. This contained 48 to 49 per cent. of iron and was frequently very friable, producing an excessive amount of fines. The ore was very easily reduced, but the loss in flue-dust was at times rather high. Owing to the steep bosh of the furnace, however (78 deg.), hanging troubles were not experienced, and it is considered that for smooth and economical operation the steep bosh is the main requirement even in comparatively small furnaces.

As the mine was developed the pure carbonate ore was reached, and this was mixed in gradually-increasing proportions with the oxide ore at the furnace. As the smelting of raw carbonate ore was a rather unusual procedure in standard practice, and in most circumstances quite uneconomical, it was at first concluded that the ore must be calcined in the best way that could be devised. With the carbonate ore containing 40 per cent. of iron, the actual content of CO_2 in the raw carbonate ore is roughly 31 per cent., while the free carbon content is 5 per cent. On complete calcination the free carbon is lost, as well as the CO_2, but there is a gain of about 5 per cent. through final oxidation of the ferrous oxide to ferric oxide, thus reducing the net loss to about 31 per cent.

Assuming calcination to be 90 per cent. efficient, a product should be obtained containing almost 58 per cent. of iron, although SiO_2 and other impurities would rise in proportion. From the point of view of saving carriage, and the possible objections to driving off the large quantity of CO_2 in the furnace, it would appear that calcining at the mine is the only sound policy, thereby obtaining a concentrated material free of CO_2.

(To be continued.)

A Record Repair Job.

A remarkable record has just been established in the repair of a breakdown to the 2,500-h.p. rolling-mill engine at the Albion Steel Works, Briton Ferry. The connecting-rod broke whilst the engine was running at full speed, with disastrous results. The cylinder, valve-casing, bedplate, piston, covers, guide-bars, guide-shoes, etc., were all smashed, and, on a survey, it was considered that the whole plant would be rendered idle for two months—a serious matter for the owners and the employees.

The repair commenced within an hour of the stoppage, and working through night and day at very high pressure, the engineers, Messrs. Taylor & Sons, Limited, of Briton Ferry, were able to re-start the rolling under three weeks from the time of the breakdown, the cylinder being cast, delivered and fixed in sixteen days. This is a wonderful record for such work, being well under half the time of any previous similar job. It is very gratifying in these days to learn that the British workman is still capable of great achievement when put to it, and we congratulate Messrs. Taylor & Sons and the Albion Staff on their great effort.

Illness of Mr. Stubbs.

We regret to announce that Mr. Oliver Stubbs, Past-President of the Institute of British Foundrymen, and President of the National Ironfounding Employers' Federation, had a seizure in Manchester on April 24. Mr. Stubbs was conveyed to a nursing home, and, although his condition is serious, there is every reason to anticipate his complete recovery in due course.

Institute of British Foundrymen.

LONDON BRANCH.

The Annual General Meeting of the London Branch of the Institute was held at the Engineers' Club, Coventry Street, Piccadilly, W.1, on Thursday, April 5, 1928, Mr. W. B. Lake (the Branch-President) in the chair.

The minutes of the previous annual general meeting were read, confirmed and signed.

It was suggested by MR. A. W. G. BAGSHAWE that, in order to meet the convenience of members of the Branch, future annual general meetings of the Branch should not be held on the day before Good Friday. The BRANCH-PRESIDENT intimated that that suggestion would be borne in mind.

The Branch Hon. Secretary and Treasurer's Report.

MR. H. G. SOMMERFIELD (Branch Hon. Secretary and Treasurer), in presenting his report of the work of the Branch for the year 1927-28, said it was with pleasure that he was able to record a large increase in membership. Adjusting resignations, deletions from the register, and transfers to and from the Branch, the membership totalled 228, as compared with 202 a year previously. (Applause.) Of the membership of 228, there were 133 Members, 83 Associate Members, and 12 Associates.

During the session seven lectures had been delivered to the Branch, and in addition the members had participated in a joint meeting with the members of the London Section of the Institute of Metals in December. Further, there was the annual general meeting of the Branch that evening.

Besides the monthly meetings the members had paid visits to the following works:—Messrs. Barford & Perkins, Limited, and Messrs. Baker, Perkins, Limited, both of Peterborough; and Messrs. Southern Foundries (1926), Limited, of Croydon. In addition, the members would be visiting Messrs. Belling & Company's works on April 28, and another visit was anticipated a little later on to the works of Messrs. J. H. Every, at Lewes.

The executive and all members greatly appreciated the kindness of all those who had contributed Papers for discussion, as well as the managements who had been good enough to extend invitations to visit their works. The annual dinner of the London Branch was the best attended in the history of the Branch, there being nearly 100 present.

It was with the deepest regret that he had to report the death during the past year of Mr. H. Reaman and Mr. B. F. Sperring, of Portsmouth.

Continuing his report, the Secretary referred to the transfer of the late President of the London Branch (Mr. R. J. Shaw), who had gone to reside in Newcastle. The Branch had been indebted to Mr. Shaw for many years for his services as honorary treasurer, as well as during his term of office as President. (Hear, hear.)

The financial standing of the Branch was quite satisfactory. The balance in hand at December 31, 1927, was £98 4s. 2d., and that of the social fund £91 11s. 2d.

The Branch Council, at a meeting held prior to the annual general meeting, had recommended for nomination the following names of officers for the ensuing year:—

President: Mr. W. B. Lake.

Senior Vice-President: Mr. J. W. Gardom.

Junior Vice-President: Mr. A. F. Gibbs.

Hon. Secretary and Treasurer: Mr. H. G. Sommerfield.

Councillors: Messrs. Bagshawe, Bartram and Hand had each two years to run.

Messrs. Clark, Cree and Shillitoe had each one year to run, while Messrs. Carrell, Dews and Wares retired this year and stood for re-election, together with any fresh nominations that might be made.

The existing delegates to the General Council were Messrs. Bagshawe, Hand, Pierce and Slater. Mr. Bartlett and Mr. Cleaver, to whom the thanks of the London Branch were due for their valuable services in auditing the accounts for the past year, had been re-elected as auditors by the Council for the ensuing year.

It was still hoped that every endeavour would be made to increase the numerical strength of the Branch, and the co-operation of all members to this end was welcomed. The average attendance at the monthly meetings, concluded the Secretary, had been quite satisfactory, when one considered the long journeys that had to be made by so many of the members.

The BRANCH-PRESIDENT, in moving the adoption of the Report, said it would be agreed that it was very satisfactory. The membership had increased appreciably, and he believed Mr. T. Makemson (the General Secretary of the Institute)—whom the members of the Branch were pleased to welcome at their meeting that evening—would be able to tell them that the London Branch had made as much progress as any other, and that if it were not the largest Branch at the moment it was very nearly the largest.

MR. BAGSHAWE seconded the adoption of the report.

Election of Officers.

MR. V. C. FAULKNER proposed that Mr. W. B. Lake be asked to preside over the conduct of the Branch for a second year. He (Mr. Faulkner) had followed very closely the work of the Branch for the past seven years, and he did not think there was any previous year in which the Branch had made such striking progress as it had in the year which had just closed. He was convinced that in asking Mr. Lake to continue in office for a second year the members would not only be paying a compliment to Mr. Lake, but they would also be doing themselves a good turn, for he was quite sure that the Branch would increase in numbers and status under Mr. Lake's wise and beneficent direction.

MR. SHILLITOE seconded the proposal, and expressed the hope that Mr. Lake would see his way to accept office again.

The resolution was put to the meeting by MR. GARDOM (Senior Vice-President), and carried unanimously.

The BRANCH-PRESIDENT, in expressing thanks to the members for the honour they had done him, assured them that it was not an honour that he had sought, although he was proud to accept it. They all knew that Mr. Gardom (Senior Vice-President) would have carried out the duties of President just as well as he (Mr. Lake), and perhaps better, but reasons had been put forward to the Council which had led them to consider that it was perhaps in the best interests of the Branch that the procedure indicated in the Branch-Secretary's report should be adopted. He assured the members that he would do all in his power, with the assistance of Mr. Gardom and the other officers, to make the work of the Branch a success in the coming year, and to ensure that the Institute's Convention, which was to be held in London in 1929, and the arrangements for which would be the responsibility, more or less, of the London Branch, would be successful. The Branch-President also expressed his thanks to the officers of the Branch for the help they had given him during the past year. At every single meeting, he said, he had had the support of Mr. Gardom, Mr. Faulkner, and practically every member of the Council. He also emphasised the great debt he owed to Mr. Sommerfield, the Hon. Secretary; with such a secretary behind him, the work of the President was very light, and he sincerely thanked Mr. Sommerfield for the help he had given.

The Senior Vice-President.

On the motion of the BRANCH-PRESIDENT, seconded by MR. BAGSHAWE, Mr. J. W. Gardom was unanimously re-elected Senior Vice-President.

The Junior Vice-President.

On the motion of MR. G. C. PIERCE, seconded by MR. H. O. SLATER, Mr. A. F. Gibbs was unanimously re-elected Junior Vice-President.

Hon. Secretary and Treasurer.

MR. SHILLITOE, proposing the re-election of Mr. H. G. Sommerfield as Hon. Secretary and Treasurer, said he had known Mr. Sommerfield for many years as a colleague and as an old member, and would like to have the honour of proposing the resolution.

MR. G. C. PIERCE seconded.

The resolution was carried unanimously, amid applause.

MR. SOMMERFIELD, in expressing his thanks, said that if there were one thing he liked to do it was Institute work, and the fact that he had carried it on for so many years, sometimes at great pressure and great inconvenience, and sometimes even when he was not quite fit for the job, was an indication that he liked the work. If there were anything he could do for the Branch and its members, and for the Institute, he would gladly do it. He thanked the members for their kindness in supporting him in everything he had asked them to do in the past year, and assured them that he would endeavour to do all he could in the coming year.

Messrs. Dews, Hotchkis and Wares were elected Members of Council, whilst Messrs. Bagshawe, Dews, Gardom and Shillitoe were elected as delegates to the General Council.

A Vote of Thanks to Branch Officers.

On the proposition of MR. WILSON, seconded by MR. T. H. GRAY, a hearty vote of thanks was accorded the Officers of the Branch for their valuable services during the past year.

The BRANCH-PRESIDENT, responding on behalf of the officers, assured the members that they had found the work a pleasure, because they believed that in working for the Institute of British Foundrymen they were really doing some good to the foundry industry. Much remained to be done, however, and they would continue to do their best during the ensuing year to merit the confidence which the members had reposed in them.

Owing to the lateness of the hour, the PRESIDENT intimated that Mr. H. C. Dews and Mr. J. D. Hotchkis, who were to have presented two short Papers for discussion immediately after the annual general meeting, had been asked to postpone them, because there would not be sufficient time remaining to enable the members to do justice to them. At the same time, he said, the members thanked Mr. Dews and Mr. Hotchkis for the trouble they had taken to prepare the Papers, and looked forward with pleasurable anticipation to hearing them on a future occasion.

The meeting then closed.

Carron Foundry Tragedy.

An accident involving the death of David Leishman, furnaceman (33), occurred in the heavy foundry, Carron Ironworks, Carron, near Falkirk, last week.

Shortly after two o'clock, Leishman, who had charge of one of the cupolas in the foundry, had his furnace fully charged and the fire kindled, and everything in readiness for beginning operations. It appears that he decided to make a final adjustment of the brick lining in the interior of the cupola, and entered by the charge door for this purpose. He had not been long inside when he was heard to shout and was seen to collapse.

James Balmain gallantly entered the furnace and tried to effect a rescue. He, however, was quickly overcome by the gas fumes, and managed to reach the door, where he was assisted out. A second attempt was made by Robert Crowe, who was let in head first, with his colleagues holding on to his feet. This, too, was unavailing, Crowe being even more rapidly overcome owing to his head being held downwards.

A third and last attempt was made by Alexander Baird, but he, too, was overcome and had to be assisted out. Eventually ropes and a hook were procured, and by means of these Leishman was hauled out. Artificial respiration was tried and a doctor summoned, but all efforts at resuscitation proved unavailing. Death was due to gas poisoning.

Newcastle Founders Visit South Shields.

A combined visit of the Senior and Junior Sections of the Newcastle Branch of the Institute of British Foundrymen was recently made to South Shields, where the party, which numbered about 90, inspected the South Shields Electric Power Station and the Ironfoundry of Messrs. Smith and Company, Limited. The Borough Electrical Engineer, Mr. Edgar, welcomed the members to the Electricity Station on behalf of the Electricity Committee. Before conducting the party round the Station, Mr. Edgar gave a short *résumé* of the items of interest. He explained how the coal which was delivered at the wharf by barges was conveyed to the boiler house by means of a receiving hopper and conveyor. The coal was fed from the conveyor to any part of the storage bunkers by suitable moving of the tipper. The conveyor had a capacity of 30 tons per hour and required practically no attention. The bunkers were carried on stanchions placed at each front corner of the boilers, which were eight in number, and were thus supported without encroaching in any way upon the floor space of the boiler house. The bunkers were of about 560 tons capacity and provided with outlets and shoots so that coal could be fed by gravity to the various grates. A valve was arranged for controlling the flow of coal, the valve being operated from the floor level by the man in charge of the stokers.

In the old engine room they would see a large amount of plant which had been out of use for a number of years. There were also two turbine sets there, one which had been put down in 1911 and the other in 1914, and these would soon have to be scrapped. In the new engine room there were also two turbine generating sets, one of which was the very latest of its kind. It was very interesting to note the difference in floor space and the height taken up by these turbo sets as compared with the old reciprocating sets which were still existing in the power station, the latter occupying approximately three times the cubic area of the former sets and only having about one-half of the capacity.

The air filter was of the "Heenan" type and was capable of dealing with twenty-four thousand cub. ft. of air per min. The filtering surfaces consist of a large quantity of galvanised steel sheeting wound in spiral form round central cast-iron discs. Two of these discs are embodied in the machine; both being mounted on a stout steel shaft running in self-aligning roller bearings. The shaft is rotated at slow speed by means of a machine-cut worm gearing totally enclosed and running in an oil bath. The lower half of the drums dip into a built up tank forming part of the casing and containing water up to the level of the cast-iron discs. The sheets in passing through the tank carry up with them a thin filament of water which is spread out over the whole surface and with which the air to be filtered is brought into intimate contact. As the distance between each adjacent pair of plates is only a little more than ¼ of an inch, it will be appreciated that the dust and foreign matter in suspension in the air is deposited on the wet surface and is duly wiped off when the sheets return to the water level.

After inspecting the engine rooms the party was taken to the storage room where there were 262 accumulators charged with electricity. Mr. Edgar said that when any of the docks had to be pumped dry they had to use some of the stored electricity as so much power was needed. There was sufficient power stored there to run the entire tramway service for about one hour, supposing any breakdown occurred in the power station. The wiring for the electric lights in the store room was specially encased with bronze and run through porcelain insulators.

The Foundry Visit.

MR. SMITH, after extending a hearty welcome to the party when the ironfoundry of Messrs. Smith's was visited, said that the most interesting thing they would see in the foundry was the system of drying for moulds. They had incorporated the August Muffle system into three stoves which were heated by one fire. He must say that it was the best system of drying of which he had had experience. Formerly it had taken 14 cwts. of best coke to dry each of the stoves whereas they now took a shorter time to dry using less expensive coke. It used to take two men to clean the stoves, while now it was one man's work and he prepared the fire for the three stoves in less than one hour.

Messrs. Smith & Company, Limited entertained the party to tea at the South Shields Masonic Hall. MR. VICTOR STOBIE, on behalf of the members, thanked Mr. Smith and his partner for their kindness in providing tea. He said that he thought that it had been one of the finest visits they had had for some time, for one thing there had been great variety, and for another, the Senior and Junior Branches had been brought together. They had been allowed to inspect the Power Station as they had liked, and Mr. Edgar had given them all the necessary explanations.

MR. PAULIN, seconding the vote of thanks, said that Mr. Edgar had given him some information which he thought they all ought to share. They had seen some magnificent plant kept in beautiful condition, and he had learnt from Mr. Edgar that it was to be scrapped, although it must seem a heartbreaking matter to put the hammer on it. The relation of the expenditure of steam in that type of turbine to the newer types was as 20 is to 11. That kind of progress must mean an increase of orders for the future. The chance they had had of seeing through Messrs. Smith's foundry and inspecting the new core stoves was one that nobody would like to have missed. Judging by the numbers that had turned up, it had proved one of the most popular visits he had had the pleasure to enjoy.

In reply MR. SMITH said that he would like to say how delighted they were to see such a large number present. When the Junior Section had asked permission to visit the foundry he had thought it would be a good thing to have a combined visit and to include an inspection of the Power Station.

Helping Local Industry.

MR. EDGAR said that he had been very pleased to show them the Corporation's Electricity Works that afternoon and he hoped that they had all seen something of interest to them. He was in the fortunate position of having the full support of his Committee and the Council and about six years ago, when it had been found necessary to extend the plant a piece of land had been purchased, which was at that time separated from the works by a street running down to the riverside. This street had been closed and the new works built. The 262 cells had to be removed from the old battery to the new one, and it had been done with the battery in commission the whole time. He hoped, of course, they would still further extend in the future and they now had plenty of room to do so. He hoped also that when the new plant was put in some of the work would be given to the ironfounders in South Shields. When the extensions had been made before he had made it a condition with the contractors that as much work as possible should be placed at South Shields, but the prices then running had not permitted of that. He always endeavoured to assist local industries as much as possible, and in that direction he always tried to place orders with local people and further to assist them by getting his committee to reduce the price of energy so that they could enter into competition with other districts. The South Shields Power Station was one of the cheapest in the country for energy. The lighting was down to the pre-war price. He had had great pleasure in accompanying them through Messrs. Smith's foundry, for he thought that the foundry was the most interesting part of engineering. With regard to the core stoves, he hoped that the day was not too far distant when they would be able to do core drying by electricity.

MR. CARMICHAEL, Past-President of the Newcastle Branch, said that although he had not been able to attend the meetings of the Branch lately owing to ill-health, he still took a great interest in the Institute, and especially in the John Surtees Memorial. He would be very pleased if the Junior Members would take more interest in the latter. He was sure that one day it would become the beginning and end of a moulder's ambition to win the medal, and that it would be taken as a standard by employers. There was more opportunity in the foundry trade for a young boy with ambition than in any other trade, and there was no reason why he should not take it up in all its branches. The object of the Memorial Fund was to help boys to better themselves.

Customs of the Trade.

As some of the British foundry employers associations are considering the question of "conditions of sale," the issue by the Steel Founders' Society of America, of 511, Magee Building, Pittsburgh, of a list of trade customs will be of considerable interest as a basis for comparison. The list reads as follows:—

(1)—When purchasers ask for quotations they should give the actual or estimated rough weights of the castings upon which quotations are to be based.

(2)—Unless otherwise arranged, quotations should be accepted and pattern equipment furnished to the foundry by the purchaser within 30 days from the date of such quotations.

(3)—Unless otherwise specified, castings are sold as unmachined castings, f.o.b. the foundry. Terms of sale are net cash 30 days from date of invoice. No cash discounts are allowed.

(4)—Pattern equipment should be in proper condition and of a type suitable for the economical production of castings of the quality, quantity and delivery required.

(5)—Before patterns are made, the purchaser should submit blue prints to the foundry that is to make the castings, to obtain suggestions concerning the best method for constructing the pattern equipment.

(6)—When the purchaser furnishes skeleton patterns, core-boxes, sweeps or conjunction patterns, which increase the cost of production of castings, an extra charge will be made.

(7)—Patterns should be painted in accordance with the following standard practice:

Surfaces to be left unfinished are to be painted black.

Surfaces to be machined are to be painted red.

Seats of and for loose pieces are to be red stripes on a yellow background.

Core prints and seats for loose core prints are to be painted yellow.

Stop-offs are to be indicated by diagonal black stripes on a yellow base.

(8)—Patterns, coreboxes and loose pieces thereof shall be properly marked for identification.

(9)—Alterations and repairs on pattern equipment shall be paid for by the customer.

(10)—The foundry shall not be responsible for loss of, or damage to pattern equipment when caused by fire or other causes beyond its control.

(11)—The foundry shall not be expected to provide storage for patterns for which no orders have been received during a period of two years.

(12)—All transportation charges on pattern equipment to and from the foundry shall be paid by the customer.

(13)—Unless requested in writing, changes in orders will not be accepted by the foundry.

(14)—To be effective, cancellation of orders must be mutually agreed to by the foundry and the customer.

(15)—After the original order is in production the customer shall reimburse the foundry for castings made or for moulds or cores discarded by the foundry due to cancellation, changes in orders or alterations in pattern equipment.

(16)—The foundry shall not be liable for damages due to failure to make delivery of castings when such delay is caused by fire, strikes, accidents or other and additional causes beyond the foundry's control.

(17)—Claims for errors in weight or in number of castings received shall be made by the customer within 10 days after the receipt of the castings.

(18)—The foundry shall not be responsible for machine work or other expense incurred on castings which are later rejected as defective.

(19)—The foundry has the right to replace castings rejected by the customer as defective.

(20)—The foundry shall not be liable for any special, indirect or consequential damages whatsoever, in connection with any castings it furnishes.

XUM

Trade Talk.

The ascertainment of Welsh Siemen's steel prices for the past three months is £5 11s. 8.88d. per ton (equivalent to 5 per cent. on the sliding scale). It involves no change in wages for the next three months.

The date of the public examination of Mr. H. Ward, carrying on business at 16, Mark Lane, London, E.C.3, iron and steel agent, has been fixed for May 15 at Bankruptcy Buildings, Carey Street, London, W.C.2.

Joseph Kaye & Sons, Limited, Lock Works, Leeds, have recently received a repeat order for 800 of their patent locks from the L. & N. E. Railway. They also have in hand orders for the Metropolitan Electric Supply Company and the Yorkshire Electric Power Company.

The Grinding & Pulverising Offices of International Combustion, Limited, 11, Southampton Row, London, W.C.1, report that twelve orders have recently been received for Hardinge conical ball mills, Hum-mer electric screens, etc., for Great Britain, Ireland, India, Japan, and France.

The British Engineers' Association reports that Dorman, Long & Company, Limited, have secured the contract for an important steel road and railway bridge over the Limpopo River in Southern Rhodesia. The bridge, which is being presented by the Beit Railway trustees, will link Southern Rhodesia with the Union of South Africa. Its 14 spans, each of approximately 100 ft., will be shipped to Rhodesia in sections.

The Brightside Foundry & Engineering Company, Limited, Sheffield, have lately taken over the European patent rights for the McKee mechanical hot bed for large and small rolled products. This mechanical cooling bed has been designed and patented by Mr. Willis McKee, of Cleveland, Ohio, with a view to providing a means for increasing the cooling efficiency of hot beds and improving their straightening action. Several installations have now been made in leading American steelworks with very successful results.

Mr. Henry Ford visited Birmingham on April 20, and inspected the James Watt beam engine at Ocher Hill Pumping Station of the Birmingham Canal Navigations. This engine is claimed to be the oldest condensing engine in the world. It is the remaining one of two made by Boulton and Watt in 1777 under patents granted to James Watt in the reign of King George III. The engine was not only designed by Watt, but the drawings were prepared by him and the engine constructed under his supervision. In 1898 this remarkable engine, having been at work regularly for 120 years, was re-erected at the works of the Canal Company at Ocker Hill and preserved as a relic, but when supplied with a breath of steam the old warrior willingly toils away as a "drawer of water." Although constructed nearly 150 years ago, this engine would, at the present time be considered a large one and outside the capacity of many modern engineering firms. The size of the steam cylinder is 32 in. diameter and the length of stroke 96 in., and the water-horse-power 18.4.

German interests, it appears, are making determined efforts to gain control of the Primitiva Gas Company of Buenos Aires, and as this concern purchases all its materials in Great Britain, the matter is of considerable importance to British industry. In fact, the chairman at the annual meeting last week made it perfectly clear that the orders placed in Great Britain represented full-time employment for 1,500 workers throughout the year, and naturally if the Germans were to secure control this business would be transferred to German works. In the course of his address to the shareholders, Mr. P. A. Cooper, the chairman, said: Shareholders have asked us whether there is any truth in the rumours that we are proposing to sell our business to the Electric Light Company of Buenos Aires. Some time before the present directors joined the board conversations took place between representatives of the Electric Light Company (the German Overseas Electricity Company, now the C.H.A.D.E.) and the old board of this company. As a result of these conversations a memorandum setting out the basis for a sale was submitted to this company. I was in Buenos Aires at the time, and although I had been a director of the company a few days only I had already learned enough to see the potentialities and to advise my colleagues that the offer should not be accepted. Indirect approaches took place at different times, and a year later another proposal for sale was made, which we found unacceptable. During the following year, that is, last year, we were twice approached from the United States of America asking us to sell the business, which again we declined to do. We have also been approached by another group. In Buenos Aires last summer, and again in London, I met a representative of the C.H.A.D.E., who proposed that our companies should co-operate. On behalf of your board I at once agreed in principle to such a suggestion. But unfortunately we found that the C.H.A.D.E. idea of co-operation was that our business was to be taken over and managed for us. We are willing to co-operate where we can see mutual advantage, but the board is convinced that this company has a great future, and we are satisfied that our organisation is quite capable of bringing about that successful future. We want to keep this company British, too—for the sake of British trade and British prestige. I calculate that by the orders we place in this country we are at the moment giving whole-time employment to more than 1,500 men in England, and the figure is rising every year.

Personal.

Mr. George Hoyland, of the Hepworth Ironworks, Crowedge, near Penistone, has been made a Justice of the Peace for the West Riding.

The Earl of Verulam and Mr. Alfred James Towle Taylor have been elected to the board of directors of Sir W. G. Armstrong, Whitworth & Company, Limited.

Captain R. C. S. Hunt, superintendent of gun manufacture, and Mr. Maurice Chapman, sales manager, have been added to the local board of directors at Sheffield of Vickers, Limited.

Mr. E. J. Fox

(Managing Director of the Stanton Ironworks Company, Limited).

President-Elect of the National Federation of Iron and Steel Manufacturers.

Mr. J. M. Allan has retired from the position of managing director of the Sheffield and Penistone Works of Cammell, Laird & Company, Limited, and also from the board. Mr. C. L. Mason has been elected to a seat on the board and has also been appointed managing director of the Sheffield and Penistone Works of the company. Mr. Allan has also retired from the board of the Midland Railway Carriage and Wagon Company, Limited.

United States Steel Corporation.—The report of the United States Steel Corporation for the quarter ended March shows that the total earnings for the period amounted to $40,934,000, against $31,248,000 for the December quarter and $53,503,000 for the March quarter last year. Net income amounted to $25,907,000, against $17,684,000 and $35,514,000, and balance for dividends $21,332,000, against $13,795,000 and $30,896,000 respectively. The directors have declared the usual quarterly dividends of 1¾ per cent. on the common and preferred stocks.

Contracts Open.

London, E.C., May 9.—Fifteen cylindrical oil tank wagons, 5 ft. 6 in. gauge, for the Bengal-Nagpur Railway Company, Limited. The Company's Offices, 132, Gresham House, Old Broad Street, London, E.C.2. (Fee 20s. each specification, non-returnable.)

Manchester, May 8.—Permanent-way special track work, for the Tramways Committee. Mr. H. Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly, Manchester. (Fee £1 1s., returnable.)

Simla (India), June 4.—The Indian Stores Department, Simla, require one sea-going steel, single-screw, single-deck steam launch, complete in all respects. Length approximately 87 ft., and of suitable beam. Mean draft up to 6 ft. The Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. (Ref. A.X. 6,194.)

Company Reports.

Dennis Brothers, Limited.—Interim dividend, 2s. per share.

Robert Stephenson & Company, Limited.—Net profits for year, £10,932; brought in, £17,242; dividend, 5 per cent.; carry forward, £17,175.

Leeds Forge Company, Limited.—Debit of profit and loss account brought forward, £188,402; profit for year, £731; debit balance to carry forward, £187,671.

Sandersons Bros. & Newbould, Limited.—Trading profit, £24,747; available, £17,733; debit balance, £3,365, brought in; ordinary dividend, 2½ per cent., less tax; carried forward, £5,707.

Cammell, Laird & Company, Limited.—Loss for year, £112,046; transferred from reserve account, £125,000; balance at credit of profit and loss account at December 31, 1926, £1,462; balance to carry forward, £12,815.

English Electric Company, Limited.—Trading profit, trustees' fees, £122,166; additional depreciation on tools, patterns and drawings, etc., £88,493; loss, £134,404; provision for certain expenditure incurred, etc., £123,905; further liability to income-tax, £63,000; balance at debit of profit and loss account brought forward, £78,590, increased to £399,899.

New Companies.

Baird Brothers (Port Glasgow), Limited, The Knowe, Bogston, Greenock.—Capital £5,000. Shipbuilders, etc. Directors: J. and E. Baird.

George Burns & Sons, Limited.—Capital £15,000. Engineers, etc., at Burnside Works, Galashiels. Directors: J. Burns and W. Mitchell.

Darlington Rolling Mills Company, Limited, Rise Carr, Darlington, Durham.—Capital £210,000 in £1 shares (60,000 6 per cent. cumulative preference). Ironmasters, etc. Provisional directors: V. G. Crittal and Sir Holberry Mensforth.

T. L. Wild & Company, Limited.—Capital £100 in £1 shares. Builders' and contractors' merchants, iron and steel merchants, etc. Directors: W. J. Raisbeck and W. Webb.

Workman Clark (1928), Limited, Belfast Shipyard, Belfast.—Capital £400,000. Shipbuilders, etc. Directors: W. Strachan, W. J. Lovett, J. Wilkie, J. W. Hamilton and P. C. Anderson.

Obituary.

Mr. W. Millar, who has died at Middlesbrough at the age of 68, was managing director of Wallace Millar & Sons, Limited, ship-repairers, and well known in business circles. For some years previously he was the manager of the ship-repairing department of Sir Raylton Dixon & Company, Limited, at the Cleveland Dockyard.

Mr. P. G. Gillespie, managing director of Gillespies, Limited, Chattan Stove Works, Bonnybridge, Stirlingshire, was killed by a train near the works on April 23. On stepping from a siding to the main L.M.S. line he failed to notice the approach of an express, and was run down. Mr. Gillespie was a prominent figure in the Scottish capital and well known in political circles. He was the senior partner in the legal firm of Gillespie & Gillespie, solicitors, before the Supreme Courts, besides being managing director of the Chattan Stove Works. He was 55 years of age.

The death occurred at Mansfield, Notts, last Friday, of Mr. William E. Stokes, well known in iron-founding circles as one of the principals of the firm of Stokes' Castings, Limited, Mansfield. Mr. Stokes, who was 81 years old, came to Mansfield to the Meadow Foundry in 1865. After a sojourn at Nottingham he returned to Mansfield and took up a position with the firm of Sansom Bros., of the Union Foundry. He later became a principal in the firm, and was in constant attendance at the foundry, now better known as Stokes' Castings, until within a year of his death.

XUM

BLACKING,
PLUMBAGO,
CORE GUM,
WHITE DUST,
COAL DUST.

ESTABLISHED 1863.

JAS. DURRANS & SONS, LTD.
PHOENIX WORKS, PENISTONE, near SHEFFIELD.

Telephone:
21 PENISTONE.

Telegrams:
"DURRANS, PENISTONE."

Manufacturers of
FOUNDRY EQUIPMENTS

LADLES,
FIRE BRICKS,
STONE FLUX,
CASTING CLEANERS,
PIPE NAILS,
SPRIGS,
WIRE BRUSHES,
BELLOWS,
CUPOLAS,
GANISTER,
LOAM AND SAND MILLS,
STUDS,
CHAPLETS,
BRUSHES,
CORE ROPES,
BUCKETS,
SPADES, Etc.

Write for Illustrated Catalogue on Blacking and Foundry Requisites, also for our latest Price List.

TEAM BY-PRODUCT COKE CO., LTD.
DUNSTON-on-TYNE
"TEAM" PATENT COKE
SPECIAL FOUNDRY QUALITY

FOR PRICE AND PARTICULARS APPLY TO:—
ALEXANDER LEITH & CO.,
25, COLLINGWOOD STREET,
NEWCASTLE-ON-TYNE.

TYPICAL ANALYSIS (if necessary guaranteed)

ASH	not exceeding	8%
SULPHUR	,, ,,	0·8%
VOLATILE	,, ,,	1 %
MOISTURE	under	1·50%

GANISTER, CUPOLA BLOCKS, FIRE BRICKS,
FIRE CLAY.
Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.
STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

J. GRAYSON LOWOOD & CO., LTD.
DEEPCAR, nr. SHEFFIELD.
Telegrams: "LOWOOD, DEEPCAR."

Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—The promise of substantial relief in the form of lower rating and a decrease in rail transport rates, foreshadowed in Mr. Churchill's Budget speech last week, has been received in Teesside with profound satisfaction, and has had an immediate effect upon the iron trade, encouraging the hope that a steady expansion of the staple industry will follow the consequent reduction in the cost of production. Cleveland iron markets during the past week have certainly reflected this impression, the tone throughout having been firm and confident, while the exclusion of foreign pig-iron from competition in the home trade, now virtually complete, gives further substantial advantage to British producers. Demand on home consumers' account is also on a steadily increasing scale, sales having been on quite a satisfactory scale, and even Scottish foundries finding it cheaper to use Cleveland or Lincolnshire qualities. Business has consequently been in quite satisfactory volume during the past week, and makers are assured already of the disposal of the bulk of May output. Prices are unchanged, quotations both for home and export orders being as follow:—No. 1 Cleveland foundry iron, 68s. 6d.; No. 3 Cleveland G.M.B., 66s.; No. 4 foundry, 65s.; No. 4 forge, 64s. 6d. per ton.

It is also satisfactory to note that the improvement in the East Coast hematite trade is now unmistakable. Not only is there a better home demand, but quite a number of orders have been booked for shipment to Continental ports. Sales have, in fact, exceeded production of late, and makers are hopeful of being able to advance prices. Nominally East Coast mixed numbers are at 70s. per ton and No. 1 quality 70s. 6d. for named brands. On the North-West Coast, Bessemer mixed numbers remain nominally at 70s. per ton at works.

LANCASHIRE.—Conditions in the local markets for foundry pig remain unsatisfactory, many of the chief consumers withholding the placing of new business in the hope of obtaining more favourable terms than those now offered by the Midland furnaces. Prices are practically unchanged, as follow:—For delivery to works in the Manchester area, Midland brands of No. 3 are at round 72s. per ton for Derbyshire and from 71s. to 71s. 6d. for Staffordshire. Cleveland is round 79s., whilst Scotch brands range from 87s. 6d. to 90s., and West Coast hematite at about 84s. per ton delivered.

THE MIDLANDS.—Buying in the markets for foundry material in this district continues inactive, while prices remain for the time being practically stationary, as follow:—Derbyshire No. 3 foundry, 63s. 6d.; Northants., 58s. to 59s.; North Staffordshire, 63s. 6d., all at furnace, with Lincolnshire No. 3 at about 66s. 6d. delivered Black Country. Ironfounders are very chary of the present situation. They themselves continue to be short of orders, and those they are getting are at very lean figures.

SCOTLAND.—The market for Scotch iron continues in a state of deep depression, and there is only a poor demand. Ironfounders all round are complaining of lack of work, and in many cases are on short time. Under these conditions they are only buying their immediate requirements, having no inducement to contract ahead. The basis price is unchanged at 70s. for No. 3 foundry f.o.t. furnaces, and makers are doing their utmost to maintain this level.

Finished Iron.

It is, of course, too early to judge the ultimate effects of the Chancellor's Budget proposals on the future prospects of the markets for finished material, but meantime it is reported that there has been a somewhat improved demand for Staffordshire marked bars at the lower price of £12 per ton, though conditions have not improved in respect to crown and the cheaper irons. There is still a very wide margin between the various quotations for crown bars. From Lancashire this iron is offered from £9 to £9 5s., and in Staffordshire from £9 5s. to £10, with nut and bolt iron anything from £8 15s. to £9 5s. Little support is possible from the local consumers in connection with bolt iron, owing to the wide difference between the Midland figures and the price of No. 3 Belgian iron. The foreign quotations are somewhat lower, and this product is being offered at £6 2s. 6d. delivered to works in the Black Country. Lancashire crown bars are on offer at £10, with second grade at £9 10s. per ton.

Steel.

In a general sense the position in the steel market discloses a slightly more hopeful aspect, some fairly good orders having been placed for ship plates, but these have gone principally to those steelworks which are connected with shipbuilding yards. The general home-trade demand appears to be expanding, although the structural steel merchants are not showing much interest in the market for the moment. The latter are reported to have plenty of work in hand, however, and will probably soon enter the market again. In the market for semis, the margin between the price of British and foreign products has not further increased lately, and British makers continue to obtain a greater share of the business, but even so the weight of bookings varies considerably, and the total quantity required is not sufficient to afford adequate employment for the mills. Some of them do not hesitate to offer concessions to the utmost limit of their ability. Officially, however, there have been no alterations in the various prices of semi-finished materials, either Continental or English. The demand for tinplates has improved, and a good volume of business has been done. The minimum has been reaffirmed, but business is not done below 18s. 3d. per basis box. The restriction of output has been removed for the time being.

Scrap.

Taken as a whole, business in the chief markets for foundry scrap metals, though not exactly brisk, continues on fairly steady lines, and in the Midlands demand is better than for some time past, heavy cast iron, machinery quality, making up to 67s. 6d. per ton, f.o.r. At Middlesbrough some of the foundries are buying fair quantities of ordinary heavy cast iron, but are not prepared to pay more than 62s., whilst machinery quality in handy pieces realise 66s. per ton. In Scotland it is rather difficult to find many outlets for heavy machinery cast-iron scrap at 67s. 6d. to 70s. per ton, with heavy ordinary cast-iron scrap, to the same specification, 5s. per ton less. Old cast-iron railway chairs are on offer at 68s. 6d. per ton, with light cast-iron scrap at 58s. 6d. to 60s. per ton. The above prices are all per ton delivered f.o.t. consumers' works.

Metals.

Copper.—A consistently steady demand for warrant copper has been maintained, but, in view of the limited stocks of rough copper in the country, holders have displayed extreme reserve, and values have been fully upheld. American advices are firm, with trade developments considered satisfactory, and a fair amount of export business is reported. Production of refined copper in North and South America in March totalled at 128,972 tons, against 124,848 tons in February and 126,973 tons in March last year.

Closing quotations are:—

Cash.—Thursday, £61 11s. 3d. to £61 12s. 6d.; Friday, £61 11s. 3d. to £61 12s. 6d.; Monday, £61 12s. 6d. to £61 13s. 9d.; Tuesday, £61 11s. 3d. to £61 12s. 6d.; Wednesday, £61 11s. 3d. to £61 12s. 6d.

Three Months.—Thursday, £61 15s. to £61 17s. 6d.; Friday, £61 15s. to £61 16s. 3d.; Monday, £61 17s. 6d. to £61 18s. 9d.; Tuesday, £61 16s. 3d. to £61 17s. 6d.; Wednesday, £61 16s. 3d. to £61 17s. 6d.

Tin.—Consumptive demand at home and abroad has influenced a slightly more active tendency as concerns cash tin, the slight downward fluctuation in values being regarded as due to profit-taking by speculative operators. Fears of labour troubles in Germany have caused some selling from that quarter, but on the whole the consumption, both in the U.K. and on the Continent, remains fairly good. Production, on the other hand, continues to increase, and the March returns for the Federated Malay States, at 5,175 tons, constituting a record, produced rather a damping effect.

Official closing prices:—

Cash.—Thursday, £232 5s. to £232 7s. 6d.; Friday, £232 15s. to £233; Monday, £230 15s. to £230 17s. 6d.; Tuesday, £229 15s. to £229 17s. 6d.; Wednesday, £231 7s. 6d. to £231 10s.

Three Months.—Thursday, £232 10s. to £232 12s. 6d.; Friday, £233 5s. to £233 7s. 6d.; Monday, £231 2s. 6d. to £231 5s.; Tuesday, £230 2s. 6d. to £230 5s.; Wednesday, £231 2s. 6d. to £231 5s.

Spelter.—Discussing the outlook in the market for ordinary spelter, Messrs. Rudolf Wolff & Company write:—It can scarcely be said that demand on the part of consumers has so far improved as to warrant the advance, but buyers have taken more interest and the market has from time to time been fairly actively supported, whilst sellers at the same time, in view of the more confident tone, have shown on the whole more reserve. The higher prices have latterly brought out a little more spelter, but there has been no great pressure to sell.

Official close:—

Ordinary.—Thursday, £26 1s. 3d.; Friday, £26 3s. 9d.; Monday, £26 1s. 3d.; Tuesday, £25 16s. 3d.; Wednesday, £26 2s. 6d.

Lead.—Buyers of soft foreign pig, having taken a more active interest of late, the market has received a certain measure of support, whilst reports from America indicating a fairly sound position there have had a sustaining influence. Consumption in this country is slow to develop, and, as there is no real shortage of metal or indication of curtailment in production, it would seem that the present recovery can scarcely attain important dimensions.

Closing prices:—

Soft Foreign (Prompt).—Thursday, £20 7s. 6d.; Friday, £20 7s. 6d.; Monday, £20 5s.; Tuesday, £20 6s. 3d.; Wednesday, £20 8s. 9d.

Britain's Largest Jar-Ram Squeeze Moulding Machine.

What is claimed to be the largest split pattern squeeze jar-ram moulding machine ever built has recently been supplied by Mr. C. W. Coleman, of 1, Lancaster Place, Strand, London, W.C.2, to an important machine tool foundry in the Midlands.

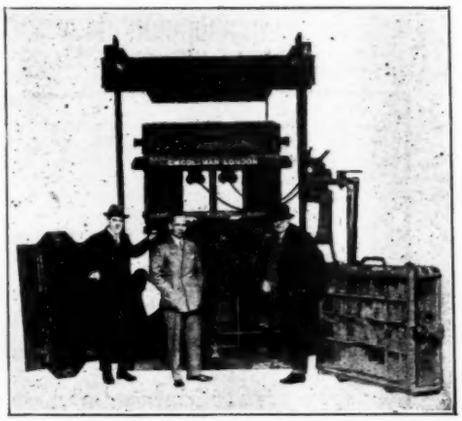


Fig. 1.—Britain's Largest Jar-Ram Squeeze Moulding Machine, by Mr. C. W. Coleman.

The machine is of entirely British design and construction, and is 11 ft. high from the base to the top of the two-rolled steel strain bars, of which there are two, each being 11 in. wide and 1¾ in. thick and weighing 8 cwt. They are so balanced, however, that it only requires one man to move the ramming head backward or forward. The weight of the ramming head and strain bars is more than 1 ton, and the balancing of the former is effected by two coil springs. The cylinder for squeezing is 36 in. dia., whilst the machine will give an actual straight draft of 18 in. and take a moulding box (one half section) of 35 in. (maximum) or 7 in. (minimum).

There are only two control levers, one for jar ramming and the other for squeezing, vibrating and pattern-drawing. The machine works by compressed air, and is fitted with two 2 in. vibrators for freeing the pattern from the sand. They strike no less than 20,000 blows per minute. The cylinder and base of the machine weigh over 5 tons, and the complete machine over 10 tons.

Another interesting detail of the machine is that it exerts a pressure of 56.5 lbs. per sq. in. on a 36 in. × 50 in. mould.

Sterling

MOULDING BOXES

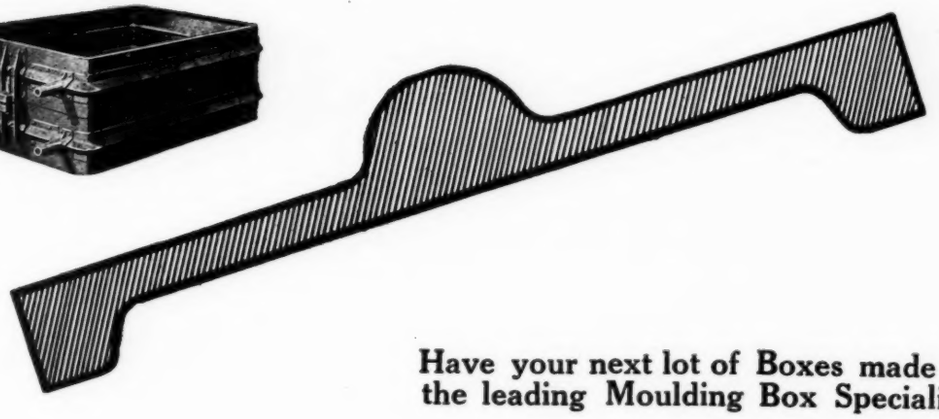
¶ LIGHTNESS AND EASE OF HANDLING;
¶ ROBUST CONSTRUCTION;
¶ DURABILITY AND LONG LIFE;
¶ PERMANENT ACCURACY.

These are the paramount essentials of the modern moulding box.

Sterling Boxes embody all these qualities. They are made from solid ribbed rolled steel of the special section shown below.

Some of the largest and most up-to-date foundries in the country are now completely equipped with Sterling Boxes.

All Sterling Boxes are made to suit the individual requirements of each Foundry. We will drill them to match up to your existing pattern plates or odd-sides and fit them with bars to suit your special patterns.



Have your next lot of Boxes made by the leading Moulding Box Specialists.

STERLING FOUNDRY SPECIALTIES LTD., BEDFORD

London Office:
13, VICTORIA STREET, S.W.1.

Telephone: 3345 BEDFORD.
Telegrams: "STERFLASK, BEDFORD."
Code: WESTERN UNION.

WEEKLY PRICE CURRENT.

COPPER

	£ s. d.
Standard cash	61 11 3
Three months	61 16 3
Electrolytic	66 10 0
Tough	64 0 0
Best selected	64 5 0
Sheets	92 0 0
India	75 0 0
Wire bars	66 15 0
Do. May	66 15 0
Do. June	66 15 0
Ingot bars	66 15 0
H.C. Wire rods	71 10 0
Off. av. cash, April	61 14 1 1/2
Do. 3 mths., April	61 16 2 1/2
Do., Sttlmnt., April	61 14 0 1/2
Do., Electro, April	66 15 0
Do., B.S., April	65 0 0
Aver. spot price, copper, Apr.	61 14 1 1/4
Do., Wire bars, April	67 0 0
Solid drawn tubes	13d.
Brazed tubes	13d.
Wire	9 1/2d.

BRASS.

Solid drawn tubes	11 1/2d.
Brazed tubes	13 1/2d.
Rods, drawn	10 1/2d.
Rods, extd. or rlld.	7 1/2d.
Sheets to 10 w.g.	10 1/2d.
Wire	9 1/2d.
Rolled metal	9 1/2d.
Yellow metal rods	7 1/2d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8 1/2d.

TIN.

	£ s. d.
Standard cash	231 7 6
Three months	231 2 6
English	232 10 0
Bars	237 15 0
Straits	234 5 0
Australian	232 15 0
Eastern	233 5 0
Banca	Nominal
Off. av. cash, April	234 6 0 1/2
Do., 3 mths., April	234 10 7 1/2
Do., Sttlmt., April	234 6 6 1/2
Aver. spot, April	234 6 0 1/2

SPELTER.

	£ s. d.
Ordinary	26 2 6
Remelted	25 5 0
Hard	20 10 0
Electro 99.9	30 0 0
English	26 7 6
India	21 15 0
Zinc dust	33 0 0
Zinc ashes	8 0 0
Off. aver., April	25 8 1 1/2
Aver., spot, April	25 9 10 1/2

LEAD.

	£ s. d.
Soft foreign ppt.	20 8 9
English	21 15 0
Off. average, April	20 8 8 1/2
Average spot, April	20 6 1 1/2

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	33 10 0
Do. V.M. ex whf.	32 0 0
Rods	39 0 0
Boiler plates	29 10 0
Battery plates	31 5 0

ANTIMONY.

	£ s. d.
Special brands, Eng.	58 0 0
Chinese	41 0 0
Crude	35 10 0

QUICKSILVER.

	£ s. d.
Quicksilver	22 5 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£ s. d.
Ferro-silicon—	
25%	8 0 0
45/50%	13 0 6
75%	20 10 0
Ferro-vanadium—	
35/40%	14/3 lb. va.
Ferro-molybdenum—	
70/75% c. free	4/6 lb.
Ferro-titanium—	
23/25% carbonless	11d.
Ferro-phosphorus, 20/25%	£17 15 0
Ferro-tungsten—	
80/85%, c. fr.	1/3 lb.
Tungsten metal powder—	
98/99%	1/7 1/2 lb.
Ferro-chrome—	
2/4% car.	£32 17 6
4/6% car.	£22 10 0
6/8% car.	£22 2 6
8/10% car.	£22 0 0
Ferro-chrome—	
Max. 2% car.	£34 15 0
Max. 1% car	£39 12 6
Max. 0.70% car	£46 15 0
70% carbonless	1/2 lb
Nickel—99%, cubes or pellets	£175 0 0
Ferro-cobalt	9/6 lb.
Aluminium 98/99%	£105 0 0
Metallic chromium—	
96/98%	2/8 lb.
Ferro-manganese (net)—	
76/80%, loose	£13 10 0
76/80%, packed	£14 10 0
76/80%, export	£13 5 0
Metallic manganese—	
94/96%, carbonless	1/10 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

	£ s. d.
Finished bars, 14% tungsten	£0 2 3
Finished bars, 18% tungsten	£0 2 9

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under 1/2 in. to 1/4 in.	3d. lb.
Do., under 1/4 in. to 1/8 in.	1/- lb.
Flats, 1/4 in. × 1/4 in. to under 1 in. × 3/4 in.	3d. lb.
Do., under 1/4 in. × 1/4 in.	1/-lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

Scrap from high-speed tool steel—	
Scrap pieces	3d.
Turnings and swarf	1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£ s. d.
South Wales—	
Hvy. steel	3 7 6
Bundled steel and shrngs.	2 18 0 to 3 2 6
Mixed iron and steel	2 18 0 to 3 0 0
Heavy cast iron	3 0 0
Good machinery for foundries	3 5 0
Cleveland—	
Heavy steel	2 17 0
Steel turnings	2 8 6
Cast iron borings	2 3 0
Heavy forge	3 10 0
Bushelled scrap	3 2 6
Cast-iron scrap	3 2 0 to 3 6 0
Lancashire—	
Cast-iron scrap	3 5 0
Hvy. wrought	3 2 6
Steel turnings	2 2 6

London—Merchants' buying prices delivered yard.

	£ s. d.
Copper (clean)	52 0 0
Brass (clean)	38 0 0
Lead (less usual draft)	18 0 0
Tea lead	15 10 0
Zinc	15 10 0
New aluminium cuttings	75 0 0
Braziery copper	47 0 0
Gunmetal	48 0 0
Hollow pewter	165 0 0
Shaped black pewter	125 0 0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	68/6
Foundry No. 3	66/-
Foundry No. 4	65/-
Forge No. 4	64/6
Hematite No. 1	70/6
Hematite M/Nos.	70/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	82/-
,, d/d Birm.	86/-
Midlands—	
Staffs. common*	—
,, No. 4 forge	62/6
,, No. 3 fdry.	63/6
Shrops. basic	—
,, Cold blast, ord.*	155/-
,, ,, roll iron*	—
* d/d Birmingham.	
Northants forge	—
,, fdry. No. 3	58/-
Derbyshire forge	60/-
,, fdry. No. 3	63/6
,, basic	—
Scotland—	
Foundry No. 1	—
,, No. 3	70/-
Hem. M/Nos.	75/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	67/6
Lincs. forge	65/6
,, fdry. No. 3	66/6
E.C. hematite	82/6
W.C. hematite	85/-
Lincs. (at furnaces)—	
Forge No. 4	63/6
Foundry No. 3	67/-
Basic	66/-
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3	72/6
Northants foundry No. 3	58/-
Dalzell, No. 3	100/- to 102/6
Summerlee, No. 3	87/6 to 94/-
Glengarnock, No. 3	87/6 to 94/-
Gartsherrie, No. 3	87/6 to 94/-
Monkland, No. 3	87/6 to 94/-
Coltness, No. 3	87/6 to 94/-
Shotts, No. 3	87/6 to 94/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.) nom.	9 0 0	to 10 10 0
Angles	—	
Tees to 3 united ins.	—	
Nut and bolt iron	8 17 6	
Hoops	12 0 0	
Marked bars (Staffs.) f.o.t.	12 0 0	
Gas strip	11 10 0	
Bolts and nuts, 3/4 in. × 4 in.	15 5 0	
Steel—		
Ship plates	8 7 6	to 8 12 6
Boiler plts.	10 10 0	
Chequer plts.	10 5 0	
Angles	7 17 6	
Tees	8 17 6	
Joists	7 17 6	
Rounds and squares, 3 in. to 5 1/2 in.	7 10 0	
Rounds under 3 in. to 3/4 in. (Untested)	7 15 0	and upwards
Flats, over 5 in. wide and up	8 17 6	
Flats, 5 in. to 1 1/2 in.	7 17 6	
Rails, heavy	8 2 6	to 8 10 0
Fishplates	12 10 0	
Hoops (Staffs.)	10 10 0	
Black sheets, 24g.	9 17 6	
Galv. corr. shts., 24g.	13 2 6	
Galv. fencing wire 8g. plain	12 10 0	
Billets, soft	£6 0 0	to 6 10 0
Billets, hard	£7 2 6	to 7 12 6
Sheet bars	£5 12 6	to 5 15 0
Tin bars	£5 12 6	to 5 15 0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1 2 1/2
Sheet to 10 w.g.	1 3
Wire	1 3 1/2
Rods	1 3
Tubes	1 8 1/2
Castings	1 2

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3 1/2 to 1/9 1/2
To 15 in. wide	1/3 1/2 to 1/9 1/2
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4 1/2 to 1/10 1/2
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5 1/2
Ingots rolled to spoon size	1/- to 1/8 1/2
Wire round—	
3/0 to 10 G.	1/6 1/2 to 2/1 1/2

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	20.76
No. 2 foundry, Valley	17.25
No. 2 foundry, Birm.	16.00
Basic	18.76
Bessemer	19.26
Malleable	19.01
Grey forge	18.51
Ferro-mang. 80% d/d	100.00
O.-h. rails, h'y at mill	43.00
Bess billets	33.00
O.-h. billets	33.00
O.-h. sheet bars	34.00
Wire rods	44.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.85
Tank plates	1.85
Beams, etc.	1.85
Skelp, grooved steel	1.85
Skelp, sheared steel	1.85
Steel hoops	2.20
Sheets, black, No. 24	2.80
Sheets, galv., No. 24	3.65
Sheets, blue an'l'd., 9 and 10	2.10
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv.	3.35
Tinplate, 100 lb. box	$5.25

COKE (at ovens).

Welsh foundry	—
,, furnace	—
Durham and North.	
,, foundry	—
,, furnace	13/9
Other Districts, foundry	—
,, ,, furnace (basis)	12/- to 13/-

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes	20×14	box	18/3
,,	28×20	,,	36/6
,,	20×10	,,	—
,,	18 1/4×14	,,	—
C.W.	20×14	,,	17/-
,,	28×20	,,	—
,,	20×10	,,	—
,,	18 1/4×14	,,	—
Terneplates	28×20	—	per box basis f.o.b.

SWEDISH IRON.

Bars, hammered,	£17 10 0 to £18 10 0
Rolled Ord.	£15 0 0 to £15 10 0
Nail rods	£15 7 6 to £15 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£8 to £12
Pig-iron	£5 15 0 to

all f.o.b. Gothenburg.

TUBES AND FITTINGS.

Up to and incl. 6 in.

	Tubes.	Fittings.
Gas	67½% ..	.. 45%
Water	63⅓% ..	.. 40%
Steam	60% ..	.. 35%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.		
April 26 ..	61	11	3	dec.	1/3
,, 27 ..	61	11	3	No change	
,, 30 ..	61	12	6	inc.	1/3
May 1 ..	61	11	3	dec.	1/3
,, 2 ..	61	11	3	No change	

Electrolytic Copper.

	£	s.	d.		
April 26 ..	66	10	0	No change	
,, 27 ..	66	10	0	,,	,,
,, 30 ..	66	10	0	,,	,,
May 1 ..	66	10	0	,,	,,
,, 2 ..	66	10	0	,,	,,

Standard Tin (cash).

	£	s.	d.		
April 26 ..	232	5	0	dec.	20/-
,, 27 ..	232	15	0	inc.	10/-
,, 30 ..	230	15	0	dec.	40/-
May 1 ..	229	15	0	,,	20/-
,, 2 ..	231	7	6	inc.	12/6

Tin (English ingots).

	£	s.	d.		
April 23 ..	238	7	6	dec.	22/6
,, 27 ..	239	0	0	inc.	12/6
,, 30 ..	236	15	0	dec.	45/-
May 1 ..	235	15	0	,,	20/-
,, 2 ..	232	10	0	,,	65/-

Zinc Sheets (English).

	£	s.	d.		
April 26 ..	33	10	0	No change	
,, 27 ..	33	10	0	,,	,,
,, 30 ..	33	10	0	,,	,,
May 1 ..	33	10	0	,,	,,
,, 2 ..	33	10	0	,,	,,

Spelter (ordinary).

	£	s.	d.		
April 26 ..	26	1	3	No change	
,, 27 ..	26	3	9	inc.	2/6
,, 30 ..	26	1	3	dec.	2/6
May 1 ..	25	16	3	,,	5/-
,, 2 ..	26	2	6	inc.	6/3

Lead (English).

	£	s.	d.		
April 26 ..	21	15	0	dec.	5/-
,, 27 ..	21	15	0	No change	
,, 30 ..	21	15	0	,,	,,
May 1 ..	21	15	0	,,	,,
,, 2 ..	21	15	0	,,	,,

AVERAGE MONTHLY PRICES OF STEEL SHIP PLATES (NORTH OF ENGLAND).

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896.....	5 0 0	5 0 0	5 2 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 2 6	5 10 0	5 10 0	5 2 6
1897.....	5 10 0	5 10 0	5 10 0	5 7 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 7 6	5 10 0	5 5 5
1898.....	5 10 0	5 8 9	5 8 9	5 10 0	5 16 3	5 18 9	5 17 6	6 0 0	6 2 6	6 5 0	6 10 0	6 15 0	5 18 6½
1899.....	6 15 0	7 0 0	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 12 6	7 12 6	7 12 6	7 12 6	8 0 0	7 6 5½
1900.....	8 0 0	8 0 0	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 0 0	8 0 0	8 0 0	7 10 0	7 0 0	8 0 0
1901.....	6 15 0	6 15 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 5 0	6 7 6	6 5 0	6 0 0	6 0 0	6 4 4
1902.....	5 17 6	5 12 6	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 10 0	5 14 7½
1903.....	5 10 0	5 10 0	5 15 0	6 0 0	6 0 0	6 0 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 10 0	5 13 11
1904.....	5 7 6	5 10 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 11 10
1905.....	5 15 0	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	6 0 0	6 10 0	7 0 0	7 0 0	6 2 3½
1906.....	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 10 0	7 0 10½
1907.....	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 8 4
1908.....	6 10 0	6 10 0	6 10 0	6 5 0	6 5 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 3 9
1909.....	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	5 15 0	5 15 0	5 15 0	6 0 0	6 0 0	6 0 0	6 0 0	5 18 9
1910.....	6 5 0	6 5 0	6 7 6	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	6 15 0	6 10 2
1911.....	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 18 4	6 15 3½
1912.....	7 3 9	7 5 0	7 5 0	7 12 6	7 15 0	7 15 0	7 15 0	8 0 0	8 0 0	8 0 0	8 2 0	8 5 0	7 14 10
1913.....	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	7 19 0	7 15 0	7 3 0	6 15 0	6 10 0	7 16 5½
1914.....	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 0 0	6 0 0	7 0 0	7 5 0	7 5 0	7 6 3	7 10 0	6 14 8½
1915.....	8 0 0	8 10 0	9 0 0	9 10 0	9 10 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 5 0	11 0 0	9 12 11
1916.....	11 7 6	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 9 2
1917.....	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1918.....	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1919.....	11 10 0	14 0 0	14 0 0	14 0 0	17 0 0	17 7 6	17 15 0	18 5 0	18 5 0	18 5 0	19 12 6	21 5 0	16 15 5
1920.....	22 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	24 0 0	24 10 0	24 5 0	24 5 0	23 13 4
1921.....	23 5 0	22 10 0	20 4 0	19 0 0	19 0 0	17 0 0	15 0 0	14 15 0	13 12 0	12 5 0	10 10 0	10 10 0	16 9 3
1922.....	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 4 0	10 0 0	9 7 6	9 4 0	9 5 0	9 5 0	9 5 0	9 18 4½
1923.....	9 7 6	9 15 0	10 5 0	10 10 0	10 10 0	10 10 0	9 18 9	9 17 6	9 17 6	9 17 6	9 18 6	10 6 10½	10 1 2½
1924.....	10 1 6	9 18 1½	9 17 6	9 17 6	9 17 6	9 19 4½	10 5 0	10 5 0	10 5 0	9 19 0	9 15 0	9 15 0	9 19 7½
1925.....	9 14 0	9 10 0	9 10 0	9 1 3	9 0 0	9 0 0	8 17 0	8 13 1½	8 7 6	8 5 6	7 16 3	7 14 3	8 15 8½
1926.....	7 12 2½	7 12 6	7 12 6	7 14 4½	7 15 0	7 16 10½	8 2 6	8 2 6	8 4 0	8 12 6	8 16 3	8 1 1½	
1927.....	8 17 6	8 17 6	8 11 6	8 7 6	8 6 3	8 5 0	8 5 0	8 3 9	8 2 6	8 2 6	8 5 0	8 5 0	8 7 5
1928.....	8 5 0	8 7 6	8 10 0	8 10 0	—	—	—	—	—	—	—	—	8 8 1½

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

PIG IRON

REGISTERED TRADE MARK

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

ENERGETIC YOUNG MAN, thoroughly conversant with all branches of Foundry work, desires change; experience includes several years in Marine and Jobbing Foundry; present controlling Brass, Iron and Pattern Shops abroad; A.M.I.B.F. and A.M.B.C.I.R.A; highest references.—Box 678, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRYMAN (23), seven years' practical experience of general engineering, jobbing, machine and repetition work, thorough metallurgical training in grey iron, cupola practice, sand control, etc., seeks progressive situation; well educated; first-class references.—Box 692, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FOREMAN requires position die-casting foundry; 18 years' controlling experience all types of work; automobile and aeroplane work specialist; all alloys, bronze, etc.; design own dies; excellent references.—Box 696, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

METALLURGIST desires post; age 25; degree; 5 years' laboratory, 4 years' foundry and general engineering works experience; thorough knowledge of foundry requirements and modern methods; moderate salary.—Box 694, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PRACTICAL FOUNDRYMAN, age 34 (leading hand with engineering firm in Yorkshire), desires position as Foreman or Assistant; working not objected to; well trained in all branches of the trade, including cupola practice; Marine, General Engineering or Jobbing preferred; good references.—Box 684, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

AGENCY.

LIVE AGENTS required in all districts to handle Core Oils and Creams; good terms offered to suitable men; excellent opportunity for men with Foundry knowledge.—Box 686, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

BUSINESS FOR SALE.

AN opportunity occurs, through death, of acquiring as a going concern a small old-established and profitable Iron Founders' business in North of England.—Apply, Box 700, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PATENTS AND TRADE MARKS.

INFORMATION HANDBOOKS, Advice, and Cons. free; King's Patent Agency, Ltd.—B. T. King, C.I.M.E. (Regd. Pat. Agent, G.B., U.S.A., and Can.), 146a, Queen Victoria Street, E.C.4. 40 years' refs. 'Phone: 0682 Central.

THE PROPRIETOR of British Patent No. 227,338, dated April 30, 1924, relating to "Improved Process and Apparatus for Disintegrating and Mixing Moulding Sand," is desirous of entering into arrangements by way of a licence or otherwise on reasonable terms for the purpose of exploiting the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. Singer, Steger Building, Chicago, Illinois.

MACHINERY.

MACHINERY PLANT, &c., FOR SALE.

PRATT & WHITNEY 14-in. Vertical Surface Grinder.

WILKINSON Automatic Rack-Gear Cutting Machine.

No. 14 "NATCO" Multiple Spindle Drilling Machine.

PARKINSON No. 7A "Sunderland" Gear Generating Machine.

Two dish-ended LANCASHIRE BOILERS, by Thompson; 30 ft. x 8 ft.; reinsure for 150 lbs. per square inch working pressure.

SEVERAL HUNDREDS OF TANKS, rectangular and circular, 10 gallons capacity upwards.

Three-ton LOCO. STEAM CRANE (Grafton); 31 ft. jib; 80 lbs. W.P.; all motions.

Thoroughly reconditioned 2-ft. gauge 40-H.P. "Simplex" PETROL LOCOMOTIVE; almost as new.

About 7,500 ft. of NEW 2-in. diameter screwed and socketed gas quality piping, in lengths of about 18-21 ft.

CATALOGUE (10,000 Lots) ON APPLICATION.

THOS. W. WARD LTD.,
ALBION WORKS, SHEFFIELD.

30-CWT. CUPOLA, 3-ft. 6-in. outside dia.; "Tabor" Rollover Moulding Machine; "Mumford" Squeezing ditto; ton-geared Ladle, 2 ft. 6 in. x 2 ft. 3 in.—Box 698, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

'Phone 98 Staines.

7-ft. SAND MILL.
Three-Throw Hydraulic PUMP.
Small Hydraulic ACCUMULATOR.
Cochran Waste Heat Boiler, 17 ft. 6 in. x 7 ft.
Vertical AIR COMPRESSOR, 150 c.f., 60-lbs. pressure.

Harry H. Gardam & Company, Limited, Staines.

SAND MIXERS.—New and second-hand. Ask us to quote.—W. Brealey & Company, Limited, Prospect Works, Hawksley Avenue, Sheffield.

PROPERTY.

11 ACRES WORKS SITE, SHEFFIELD.
145,000 Sq. Ft. of SHOPPING, Compact and Convenient.
SIDING CONNECTIONS
with L.M. & S. and L. & N.E. Rlys.
WELL-BUILT & COMMODIOUS OFFICES
Will Sell whole or in lots to suit customers, or Let on favourable terms. Unique opportunity for Manufacturers.
Apply—
THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

MISCELLANEOUS.

CHARCOAL.—Powdered, granulated, lump, blacking; inquiries invited.—J. Buchanan & Company, Ashfield Road, Altrincham, Cheshire.

TERRA FLAKE, Superfine Italian. We have a large consignment to deal with, and offer during May month at one shilling per cwt. below our list's figures. (See our April Catalogue, page 4, Facing Dust.)—Wm. Olsen, Limited, Cogan Street, Hull.

PATTERNS.—Inquiries solicited; quotations by return; shop equipped with modern machinery; quick delivery.—Cleghorn & Company, Midland Pattern Works, Spring Gardens, Worcester. 'Phone 264.

SPRIGS or WIRE PINS?—We supply both. See reduced prices—our April Catalogue, pages 10 and 11.—Wm. Olsen, Limited, Cogan Street, Hull.

'Phone: 287 SLOUGH.

TILTING FURNACES

150 lb. M.R.V., Cokefired, NEW	...	£36
250 lb. MORGAN, Cokefired, NEW	...	£50
440 lb. M.R.V., Cokefired, relined	...	£42
600 lb. MORGAN, Cokefired, relined	...	£80
800 lb. MORGAN, Cokefired, relined	...	£90
1000 lb. M.R.V., Cokefired, relined	...	£80

EVERY SIZE LADLE (1 cwt. to 15 ton) in Stock

LARGEST STOCK OF FOUNDRY PLANT IN ENGLAND. PLEASE SEND FOR LISTS.

BUY FROM ME AND SAVE MONEY.

Alex. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH.

Let THE JIMMY do it! Foundry Problems Solved

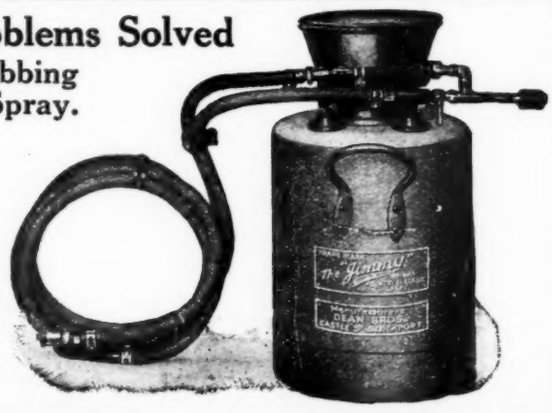
Do away with the old-fashioned Swabbing and use the "Jimmy" Mineral Blacking Spray.

STRIPS HEAVY CASTINGS CLEAN

THE BEST LABOUR SAVING TOOL IN THE FOUNDRY

WONDERFULLY EFFICIENT
ACCELERATES PRODUCTION

Do away with hours of Swabbing and make them minutes. Pays for itself in a week.



Send for particulars and Price List to the Sole Makers and Patentees. *TEL.: 3909*

DEAN BROS., CASTLE STREET, STOCKPORT.